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A

SUPPLEMENT

TO

"THE AMATEUR'S PERSPECTIVE."

By RICHARD DAVENPORT, Esq.

LONDON:

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ADVERTISEMENT TO THE SUPPLEMENT.

THE former part of this work concluded with an intention of treating further of some parts of the subject which had been but slightly mentioned; particularly the theory of the FIELD OF VISION, and POINT OF DISTANCE; of the height of the HORIZON-LINE; and the position of the PRIME VERTICAL line in the picture: but it was proposed that the publication should depend on the reception the foregoing pages should meet with from the Public.

Without waiting for the result, the Author has since considered such parts to be essential to the theory, and the work incomplete in its plan without the introduction of them.

In a paragraph on mechanical aids, the inventor of the *Camera Lucida* was alluded to in friendly jocularity. No recollection of him can now occur without lament. A copy of the book was sent to him from the country by the Author, who anticipated a smile at their next meeting; useful criticisms on the treatise, and assistance in the part that remains. Indeed, one motive the Author had for pausing where he did, was the hope of being thus furnished with more concise demonstrations, and happier illustration of his theory. Alas, the days of his friend's smiles were past, and the hours that remained were too valuable to be employed in the perusal of a work of such minor importance. He is no more. He has vacated a department in the philosophical world, which probably no man living can supply.

There may be greater astronomers,—greater mathematicians,—

greater chemists,—geologists,—botanists,—more able and practical mechanics,—more experienced physicians;—but the astronomer,—the mathematician,—the optician,—the botanist,—the chemist,—the physician,—the natural philosopher,—the civil engineer,—the mechanic, (of every description, maker of steam-engines, chronometers, telescopes, barometers, hydrometers,)—the metallurgist,—the framer of every useful invention, down to the manufacturer of caoutchouc-cloth, all derived assistance from him. He stood as interpreter between the sciences, and enabled each one to give its aid to the others.

In generalization of knowledge,—minute precision in the observation of phænomena,—in almost undeviating sagacity in investigation, —inexhaustible resource in his adaptation of means, and ingenuity of contrivance,—in quickness and universality in the application of analogies,—Who can compete with WOLLASTON?

This help failing, the Author resumes the subject alone; and will endeavour to methodize and abridge what he had prepared for the desired revision.

JANUARY, 1829.

PREFACE.

During the preparation for this additional publication, the Author busied himself in looking over such works as he had not had access to before on the subject, but which time had now given him an opportunity to procure; and if he had been, from the first, aware of their number, he probably should not have ventured to add to it. Yet he can now deliberately refer to his former Preface, and declare that he has not found the reasons he then gave for his intrusion, removed; and that he does not repent the having put in his claim to the attention of his fellow amateurs: still believing that those who have wished to be acquainted with the theory of perspective, and have been deterred from it by the apparent difficulty, will find it capable of being simplified and rendered even amusing.

Of the works he has bestowed attention on, the greater part are more or less referred to in the following pages. He has not said much of Malton's, though it is one frequently referred to by other writers. Mr. Malton favours his readers with nearly as many words as might go to an entire treatise, in discussing the NATURE OF LIGHT, and in "*exposing Sir Isaac Newton's absurdities*"!!! and when a reader's attention is wearied by such means, he is less disposed to attack and follow through a large thick small-printed book, with all the intricacies of its numerous plates and references. If the duty of a young artist leads him to the study of them, they will hardly tempt an amateur to work through them; and the Author confesses he has not had the courage to undertake it. He will say more; he did not find himself at all repaid by such as he did study.

Here he must refer to a mistake he made in his former Preface; viz.

in designating Dr. Brook Taylor's work, as one "somewhat dreaded." He had never seen it, nor perhaps can it now be procured; and the friends whom he had heard speak of the time they had bestowed on it, and the little practical knowledge they had gained by it, meant the publications written in continuation or explanation of it, and which bear the name of Brook Taylor in the title-page.

Mention should also be made of a very good book intitled, "Elements of Linear Perspective," by D. Creswell, A.M. &c. &c. But Mr. Creswell says, "the first six books, and part of the eleventh, of Euclid's Elements, are the only books necessary to be read, in order that the whole of what is here delivered may be understood." His book therefore, however well calculated for the meridian of Cambridge, will not answer the purpose of every tourist; while the present Author (notwithstanding the confession of disappointment he is about to make) still flatters himself that the "AMATEUR'S PERSPECTIVE" will sometimes be used on rainy days on the banks of Loch Lomond or the Rhine, and on the Bay of Naples. Mr. Creswell is perfectly aware of, and expresses extremely well, the deficiencies and *unnecessary* intricacies of most of the books; and the Preface to the former part of this work might have been rendered more concise, had the Author fallen in earlier with Mr. C.'s book. He cannot but think, however, that his objection to the introduction of the *geometric plan* in the theoretic process is unfounded. The reader will long ago have perceived that it is not intended to be used generally in drawing, but is given in illustration of the principle, which assuredly it does facilitate. In fact, the measurements on the base line and on the side lines are all that are wanted; and the geometric plan teaches the student to find the desired points; and the Author will still venture to contend even against Mr. Creswell, that the plan is more simple (even for a mathematician) than that of "the ELEMENTS"—*as* generally, applicable,—and *as* strictly, demonstrable; and that it is not "impossible," as Mr. C. declares it to be, "to put the reader in possession of the principles of perspective without requiring of him the knowledge of geometry."

Every one knows the meaning and use of lines of longitude and

latitude on a map. Every one knows what is the meaning of a horizontal ground-plane, or plan, or map. Then if a portion of the picture is laid out as the perspective representation of that ground-plane, the perspective of the lines of latitude and longitude proves even to the beginner, the place in the picture where the desired point is, supposing it to be on the ground-plane: and this is given (in the present system) simply by drawing two lines from the marked points on the base, to marked points on the horizon-line. *This* requires no previous knowledge of geometry.

Then suppose the point wanted not to be on the visible flat ground, still it must be vertical to some point on that plane; and all we have to do is, to find that point as before; and by the measurement on the side-lines, we ascertain the length of that vertical line, which gives the height. Here again no knowledge of geometry is wanted, and the thing is done,—the *perspective* is right,—the lines are in their places. The rest is the art of the painter; and to attempt to acquire and practise that, without a previous knowledge of perspective (though many persons do make progress in it, and produce pictures not void of excellence), is just the same thing as to learn music without the pains of learning the notes; which art likewise some people do so acquire; at least as far as singing or playing tunes may be satisfactory to them. In a word, any person of education may acquire so much of the theory as will not only correct their own practice, but enable them to comprehend and enjoy the true representation of natural and architectural scenery with *far less* time and attention than would be sufficient for learning the common rules of arithmetic.

The origin of the work was shown in the DEDICATION. The Author has sometimes seen an incredulous smile when the *time* there held out as requisite to learn the system was mentioned, or when he attempted to vindicate the promise; which yet seriously he is not unable to do, claiming only some allowance for additions since made: for, (hoping that the introduction of his justification will not be deemed trifling) he can say, that wherever the request made to friends, to read by the hour-glass, was complied with, those friends (of both sexes) who have

declared they sat down to it quite ignorant of the subject, and unacquainted with the elements, or even terms of geometry, have reported that the time limited had proved sufficient, not only for reading, but digesting the work, going through all the diagrams and references; and that they did not need a master to explain and instruct.

This morsel of *egotism* it is hoped will be forgiven; for if "simply the writing a book" when the Author has no excuse for it, is a crime, he cannot be much blamed for pressing the excuse he thinks he has. The perception of the truth of the adage *Docendo disco* is a powerful motive, but a selfish one, and therefore no excuse. It is, to a certain degree, learning at the expense of others.

One ground for repentance he has, but no cause of *blame*. The book grew upon him; and the multiplication of the Plates has put him to more cost than the price fixed can replace: against that, he will set the gratification of the notice taken of it by individual friends, though "not yet" by the Public. Still he cannot withhold his desire to supply in such degree as is in his power, that which appeared most essential, but without attempting to follow up the subject so far as it might lead him.

"*Liber ibis in urbem.*"

JULY, 1829.

SUPPLEMENT.

CHAPTER I.

On the Field of Vision.

THAT the field of vision depends entirely on the distance of the point of sight, *as compared with the width of the picture,* is obvious: a comparatively distant point of sight contracting the field, a nearer one enlarging it: (see Sect. III.) and this of course may be varied in two ways; *i. e.* either by widening or narrowing the picture when the point of distance is determined, or by lengthening or shortening the line of distance when the width of the picture (or length of the base) is determined.

But it has been seldom or never noticed, that the *field of vision* relates as much to the extent of the vertical as to that of the horizontal direction of the picture; to the height of the sides as well as to the length of the base; and this point will be discussed in its place; at present the question will be confined to the *width*. It is commonly said in the books, that "no greater field should be comprehended in the picture than what the eye will take in without moving:" but the eye moves as much from one point of a picture to another, as from one object to another in the field of vision in nature. This rule therefore fails.

In others it is said that it should be limited by what the eye will take in without the *head* being moved. This is a more faulty rule than the other, and needs not much notice. The matter is in truth more intricate than at the first aspect it may appear; and it is not only difficult to lay down a precise law for the allowable extent of the field, but even the ground of any limit at all (or any much short of the semicircle) is not obvious.

Distinct vision extends to but a very small distance wide of the point to which the eye is expressly directed. When the eye is fixed on one point, it may *see* objects so wide from that point as to comprehend an angle as great as 170 degrees; which is very sensibly felt, if two candles be placed at such a width apart as to form that angle with the eye when it is fixed on an object

in front: but to how very small an angle *distinct* vision extends, may be proved by the observation that a person looking in a mirror cannot see his own eyes move. Let him approach or recede from the glass, looking at the pupil of one of his eyes, and finding the distance from which he can most perfectly see the minute divisions of the iris. (Twice the space between his eye and the glass, is his distance of most distinct vision.)

Keeping his face perfectly steady, let him, by the motion of his eyes only, inspect the pupil of the other eye. If another person watches the motion of his eyes as he alternates his inspection between his right and left eye in the glass, to such person the motion of his eyes will be perfectly perceptible, but not at all to the spectator himself. Nor can he, while looking at one eye, perceive that the other is more inflected, as it must be, towards the bridge of the nose. This shows to how small an angular distance *distinct* vision extends.

We can see strong contrasts of light, and shade, and colour, at a very wide angular distance: but our perception of forms diminishes in an undefined ratio from the very centre of the field of vision; and if the picture were confined to the extent of distinct vision of an eye unmoved, all that could be represented would be, a small portrait, or a single countenance on a small scale; a flower, or other small object, or a distant object such as a telescope will take in.

Now since in such landscapes and other pictures as we are accustomed to, the spectator must move his eye from one object to another; and since the magnitudes of spaces in the picture will be always proportional to those in the scene itself, and the perspective of objects that lie wide of the vertical line will be proportionally wide of that line in nature,—why should the picture be limited in width, or the point of sight be prohibited from a near approach? Why should not the eye approach the pane of glass (Sect. I.), and take in as wide a scene as lies before it? Or at least, why may it not extend to as much of the scene as *is visible*, though indistinctly, to the eye unmoved in one place? it being admitted that in viewing either picture or original, the eye changes its direction for distinct sight.

One answer obviously presents itself. The size of the picture being limited, the more extensive the field of vision is, the more diminutive must be the several representations of the several parts. The *scale* becomes too small. This forms some limit, but not the only one.

It is true that by some association and habit we do comprehend the perspective of a picture, though that picture be viewed from different distances and in different directions. With the exception of a few pictures contrived

for the purpose, we never fall really into the illusion so as to imagine we see through the picture as a glass, but are distinctly aware that we see a *surface* on which the scene is delineated: still we refer the point of sight in our imagination to some point at a certain distance, or at least to a certain *direction;* viz. to one perpendicular to the plane of the picture. If we see a picture obliquely, still we know that the surface represents that which we should see beyond a window *in front,* and not what we should see through that window in the same oblique direction in which the picture is seen: and on a little consideration it will be found that the nearer that point is to the window, the greater would be found the aberration from it, on changing either distance or direction of the eye of the spectator.

Thus let the screen-pole (Sect. I.) be placed at a proper distance from the pane, and directly in front of the centre, and let the spectator observe particularly the objects that are comprehended in the field of vision. Let him remove to a certain distance, and somewhat out of the original direction, and observe the difference of the scene. Let him then place the pole at a less distance, and having made his observation, again remove to a place equally distant from that, and observe how much greater is the comparative variation of the scene caused by the change of place in this shorter distance. Now, to transfer the point of sight in imagination to its true place, under this greater variation, will in fact require a greater effort of mind than habit enables us to use.

Our conceptions arise from habits of association; habits entirely beyond either command or controul: we are even unconscious of them at the very times when they regulate and command our ideas. When a man sees himself in a looking-glass, he imagines a figure in the perspective, of the same size as himself, and at the same distance beyond the glass, at which he stands in front; and he thinks nothing of the *surface* of the glass. Now suppose that glass to be the picture. His image would be, on that surface, exactly of half his natural size; and if he will trace it with a little whiting on the glass, he will find it exactly of that measure. Not only does it not give him that idea, but he finds it difficult to believe the fact. He says, "I see that image, in stature equal to mine; and I see other persons and all the objects in the room, of their natural size:" and yet he must be aware that the whole surface of the glass is not so large as a single figure. This is the illusion of true perspective.

He also knows that if he moves, the relative position of all the objects is changed. If he were looking *through* a glass into a similar apartment, the effect would be altogether similar; but if instead of a transparent or reflecting

surface a picture is substituted, the objects do not move with his eye, and the illusion is lost: still his imagination enables him to take in the design of the painter, and to understand the picture as if he viewed it from the true point of sight. In fact it is seldom we do view a picture from its true point of sight, but almost always from a greater distance, and in a less true direction; and it is reasonable to expect (and experience proves) that the more different that position is from the true one, the worse will be the effect; and it is obvious that the nearer the perspective point of sight is to the picture, the greater will be the difference between that and the usual distances of the spectators.

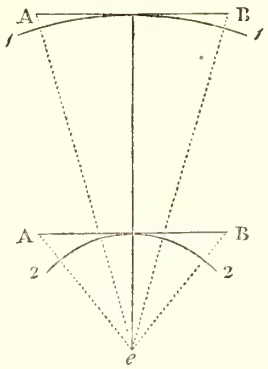
Besides, distinct vision does not take place within a certain distance in front. The distance is different in different persons; but in all, distinctness of sight is destroyed by the approach of the eye within *some* distance of the object: so that if the eye were brought so near to a small picture as to correspond with the perspective point of sight when the line of distance is very short, the picture would be invisible.

Suppose a drawing of ten inches wide, and the line of distance to be less than half the length of the base; few eyes would distinguish the objects at all at that distance. This is a second ground for defining some limit, within which it would be objectionable to place the point of distance of the perspective.

Further, though it will not be admitted (without some qualification at least) that the *distortion* of the objects which the books object to, takes place, it is yet true that the perspective of objects near the outer extent of the field of vision, differs more from their natural or geometric form, than those nearer to the centre; and this must constitute a difficulty in the conception, and therefore require a limit: but there is another difficulty which may well be conceived to take place, perhaps more generally effectual, though not so obvious, nor so easily and distinctly to be apprehended, nor indeed so palpably to be proved.

There is a faculty by which our eyes are able to distinguish distances. Writers on optics, as well as anatomists, have disputed amongst themselves as to the foundation of this faculty; but of the fact, that we do possess it, all persons are conscious. Now, objects at equal distances from the plane of the picture, are at different distances from the eye. Such as are wide of the central point of view, are further distant than those to which the eye points directly (*i. e.* perpendicularly) through the plane of the picture, though equally distant from that plane. It is probable then, that the imagination refers them to an interposed curve, rather than a plane surface (there is an

apt illustration of this in the species of painting called *Panorama*, in which the illusion is in general much more easily effected than in a flat picture); and it is evident that a distant plane surface is much more easily rendered, in the imagination, conformable to a curve, than a near one can be; circles of larger radius approaching nearer to a right line, than those of a short radius.



A. B. right line.
1. 1. arc of circle with long radius.
2. 2. arc of circle with short radius. The dotted lines the radii of the circles.

A. B. then may be considered as a horizontal section of the plane of the picture; 1. 1. the large panorama; 2. 2. the smaller panorama: and it is evident that the picture is more conformable to the larger than to the smaller; which it will be when viewed from the greater point of distance.

It will probably now be conceded that this must enter into the estimate of the *grounds* of limitation of the field of vision (nearness of the point of sight compared with the size of the picture); and it is now made evident, that the longer the radius of distance is, the more nearly will it conform to the distance from which the picture is most frequently and most conveniently to be seen:— the less will be the aberration from truth in the various *directions* in which it is viewed,—and the less will the plane of the picture differ from the curved surface on which the forms of objects would be most truly delineated by their visual rays.

Further, the apparent distance of objects seen by *one* eye from a fixed point, depends on the relative *proportions* of those of known magnitude; on the intensity of light, and shade, and colour; and on their *perspective forms* as differing from their geometric forms; equal objects diminishing in the distance as to their parallels of latitude, (Defin. 19.) in a greater ratio than in the direction of their longitudes. (Compare any of the squares of pavements, &c. in the foregoing plates.) This effect it is the office of the painter

to imitate; but not only are there *difficulties* which require genius, observation, skill and experience, to overcome them, (such as the infinite gradation of light and shade, of absolute colour, of local colour, hue and intensity, of the change of colour by the *direction* in which it is reflected from the infinitely varying positions of small and irregularly curved surfaces,) but there are some circumstances which *insuperably defy* imitation, except so far as a transitory illusion to an eye at a fixed point, may be so called.

When we look through a glass or into a mirror, we lose (as has been said,) all idea *of surface*. In a picture we see the surface, and therefore cannot conceive of the forms, as existing beyond that surface; and it may be made manifest that however much the skill of the painter may do towards the removal of the appearance of surface, the perfect accomplishment of the intention is an absolute impossibility.

Let a person hold up his finger, or any slender opake object, directly in front of his face, with a lighted candle or any conspicuous object (such as a dark line on light ground, or light on dark) beyond it. If he looks steadily with both eyes on his finger or opake object, he will see that object clear and strong; and he will see two fainter images of the candle or object beyond. If he looks steadily at the candle or remote object, he will see that clear and single; and he will see two fainter images of the near object.

If he looks through a window or into a mirror at a strongly visible point somewhat distant, with any intervening spot or line on the surface of the glass, (such as the upright slender frame between two panes,) he will see the distant point plain and single, the nearer spot or line faint and double: and if he fixes both eyes on that spot or line, that will be single and plain, and the distant object will appear faint and double*.

Also, if in either of these experiments (that with the finger and candle, or with the spot on the surface of the glass) he fixes both his eyes on the near object, keeping the distant object in the direct line behind, and maintaining steadily that position, covers one eye (the left for example), the distant object will come out towards his right; and if he removes the covering to the right eye, the same object will come out towards his left. Or if (with the same manœuvre of removing the covering from one eye to the other) he fixes his eye on the *distant* point, the *nearer one* will present the same appearance of removal to the contrary side.

* A near-sighted person, or one in whom the foci of the two eyes do not correspond (and there are many who are more near-sighted with one eye than with the other), will not so readily find this effect of the doubled image.

Now if this experiment be made with the picture, relatively to two points, one exactly over the other, but nearly in contact, and intended to represent, the one a distant, the other a near, object in the view, in perfect perspective of place, form, light, colour, &c. it is evident that no such apparent doubling of either object, nor such apparent change of place, will present itself.

All this arises from the change of inclination of the axes of the two eyes. They must converge towards the point they look at, near or distant. When the point is very distant, the axes are nearly parallel; when near, the convergence is strong; but in a picture, the representation of a distant object is not really further from the eye, than that of a near one; and therefore does not require any change of inclination of the axes of the eyes.

Another instance may be given in illustration of the proposition. A near-sighted person sees distinctly objects that are near, but does not see those at a distance without the aid of a concave eye-glass. A far-sighted person the contrary. Either of these would find some point from which they can most distinctly see the picture; and however well the distance may be expressed in the picture, from that point will they best see every part.

Still we may go a step further, and say, that (setting aside the conformable direction of the two axes, and supposing one eye only employed, and at a *fixed* point of sight,) there is an effort of which we are unconscious, but which careful experiment will convince any one we do make, producing some change in the interior of the eye, and adapting it to the view of distant or near objects, though in the same line of direction.

Let one eye, (the other eye being covered), be fixed on some visible point on a transparent surface (pane or mirror), and a distant point in the original be steadfastly observed; the spectator, scrutinizing his own sensations, will find that he must necessarily make an effort (such an effort as will fatigue him if much repeated) to accommodate his eye to the distinct vision of these two points alternately. The same will be, if by way of experiment he should try to copy on a sheet of paper before him (still using only one eye) part of a large picture on the wall of the other side of his apartment. Whence then arises the fatigue which the eye suffers?

There is a semblance of paradox in the phrase "making an *effort unconsciously;*" but very many of our habitual actions are composed of such efforts; who, for instance, when he writes his name, thinks of the muscles on his fore-arm? Yet every turn of his pen is directed by them, and the effort made in and through them is purely voluntary. This species of effort is equally evident when we contemplate the actions of our eyes.

The dilatation and contraction of the pupil of the eye to adapt it to the reception of more or less light, is too much forced upon us to justify the calling it, unqualifiedly, an *effort:* but when we take particular pains to examine very minute objects, we make a painful effort, of the nature of which we are quite unconscious. All know the fatigue of reading small print (or indeed, with insufficient light, any print). Now if the eye were merely passive, what can fatigue it? Mere scarcity of light is rather a relief than otherwise. The eyes, being open, must be filled with rays from every surface on which they are bent, whether the objects are large or minute. The rays from the page give no pain, unless an exertion is made to *distinguish* them. If this exertion were merely mental, the organ of the eye could not suffer from it. It is a bodily effort, purely voluntary, painfully exercised; and yet we are entirely unconscious what it is, and know nothing of its nature till the science of the anatomist comes to aid the investigation of it. It is in fact only of late years that the existence of the acting muscles was demonstrated*.

Let us imagine the infinite number of visual rays from the landscape in nature passing through a perfectly transparent, and therefore invisible, plane. A perforation of half an inch in diameter in a card held near one eye may represent such a plane; and such would be of less than a 12,000dth part of an ordinary sized picture by Claude Lorraine; but would contain in that small space an infinitely finer representation than the skill of a painter could produce on the largest surface he might choose to fill. Let us suppose that plane to arrest those rays in all the perfection of form and hue; such plane would then be a *perfect* picture. A larger plane at a proportional distance would represent *as* perfect a picture, and would give in the eye, or in the hole in the card, a representation equal in size, in all parts similar in form, and equally perfect in colour, &c.

Suppose the spectator to view a scene in nature in which some large object (St. Paul's Cathedral for instance) is at such a distance as to subtend an angle at the eye, of one degree (*i. e.* the 360th part) of the circle of the horizon; of whatever magnitude our transparent plane or picture is supposed to be, that object will still subtend an angle of one degree. Thus, let the last-mentioned large plane be supposed to be at the distance of six feet from the spectator; if he approaches the picture by one-third of that distance (or two feet), the fixed object will subtend an angle of three degrees: but he may walk some hundred times that distance towards the cathedral itself before its enlargement will be perceptible, and many miles before his movement will enlarge the

* By Travers, if the Author does not mistake.

angle equally with that of the object in the picture. In fact, if the field of vision within the frame were occupied by a transparent plane, the motion of approach of the eye towards it would give a visible expansion of the whole field; comprehending an additional extent of view, but no sensible enlargement of the parts: but if the forms of objects were depicted on the plane, the approach to it would apparently enlarge the whole picture and every object in it, but would not enlarge the field of vision so as to admit any greater extent of view. In the transparent plane, different effect would be sensible under the slightest *motion of approach:* and as to direction, the slightest *side motion* would admit extent of view on one side of the open field of vision, and hide as much of it on the other side; while in the fixed picture it would produce no change of view at all.

Not only then is the skill of the painter inadequate, in degree, to produce on a given surface an appearance imitating that of space (*i. e.* an appearance of distance between parts which are contiguous on the surface of the picture); but it is plain that the utmost power of execution can do nothing *towards* satisfying either the mathematical tests which even the slightest variation in the *direction* of views of nature furnishes us with, or imitating the mysterious functions of the natural organ of sight: and it is plain that the difference between the appearance of space and the appearance of well-painted surface is much less in a picture whose point of sight is distant, than in one with a near point: but it is also evident that the limit of prohibition is subject to no strict line of demarcation, but is only a matter of discretion;—that the painter may make his distance as short as his skill will enable him to do, consistently with the illusion he desires to produce.

A little experimental observation will show the reader that a line of distance, equal only to the axis of an equilateral triangle (the base of the picture forming one side, making an angle of 60°; see Sect. III. page 5.) borders on the limit of too much difficulty; and that one equal to the base of the picture is better; and if he is not anxious to bring in more field of view, a still longer line of distance will have a better effect, as better favouring the illusion. In landscapes with uneven foreground, a larger field may be allowed, than where the forms of objects in the original are regular.

There is a difference also between *a high and low base,* quite distinct from *horizon-line.* In the former, a shorter line of distance is practically admissible than can be in the latter. This will be discussed in the chapter on the horizon-line, in which place the *vertical* as well as *lateral* extent of field of vision will be brought into discussion.

CHAPTER II.

On the Horizon-Line.

Lest the assertion in the former part of this work, that "none of the books have given a just theory of the foundation of perspective, and particularly as to the theory of the horizon-line," should appear too bold, it may be required that some account of what they do say shall be given.

"Pozzo's Prospettiva," the "Jesuit's Perspective," "Highmore, on Brook Taylor," amongst the old ;—"Ferguson's," the "French Encyclopédie," and "Chambers's," in later times ;—and "Rees's Encyclopedia," and the "Britannica,"—Malton, Peter Nicholson, Francis Nicholson, Wood, Brown, Edwards, and Charles Taylor, amongst the moderns,—say so little on the subject, that to offer extracts from them is unnecessary. Kirby, on Brook Taylor, has the following paragraph :

> "The height of the eye in easel-pictures is left entirely to the discretion of the artist ; yet, in general, low horizons have a much better effect than high ones : for which reason the height of the horizontal line *should never exceed half the height of the picture :* and I believe a little experience will teach any one that if it is made equal to only one-third of the height of the picture, it will be the most proper height of any,—I mean as to easel-pictures : for if the picture be a fixed one, then the height of the horizontal line must be exactly level with the spectator's eye."

The paragraph is confusedly constructed. The writer must have meant by a fixed picture, one whose base is on the plane of station of the spectator, the foreground on the scale of nature,—and the figures as large as life, and not larger. In fact, the *exception* has no meaning : and all that remains to be noticed, is, his rule for limiting the height of his horizontal line ; and this rule is now to be examined.

Mr. Varley says, (in a sheet intitled "Practical Treatise," &c.)

> "The horizontal line is the proportion of height between the top and bottom of the plane or picture at which the spectator views the same. It would, in most cases, look formal if placed across the middle of the picture so as to divide it in half : therefore Claude Lorraine has generally made it about one-fourth the height of the picture from the ground-line or bottom of the plane

or picture, and which is the most natural appearance for open landscape, where the sky and trees are pre-eminent on the space they occupy.

"Gaspar Poussin frequently placed his horizontal line about one-third from the top of the picture, which inclined it to a bird's-eye-view, *where the land appears much larger in space than the sky.*"

It goes on to say (as the truth certainly is),

"That in the centre of this line all the *direct* lines vanish, &c. and all that are *oblique* vanish in other points of the same line;" and that "this line is the height of the spectator's eye."

It would follow then from this, that if the painter took his view *from the margin of a lake,* and introduced a lofty mountain reaching (as it must do) nearly to the top of his picture, such would be "inclined to a bird's-eye-view:" yet if the writer of the paragraph were asked by a scholar the meaning of that term, he would say that it signified a scene as viewed by an eye situated (as that of a bird may be supposed to be,) at a great height *above.*

Mr. Hayter says, in his "Dialogues,"

"One-third of the height of the picture is the most general rule for landscape: but it may be sometimes proper to deviate.

"When you take a view from an *eminence,* you must consequently have a high horizontal line; and if you make an *eminence* the *object* of your view, you must have a low horizontal line. Antique and public statues being on elevated pedestals, must have a low horizontal line; and whole-length portraits of distinguished persons: but subjects of familiar life, or less noble characters, are better characterized by a high horizon. The likeness of a dog must have a high horizontal line; but of a horse or an elephant, low."

Is it then forbidden to put a horse, a dog, and an elephant in the same picture; or can the artist contrive to produce a picture with three different horizons?*

* As Mr. H.'s book is written in the form of children's dialogues, it is possible the reader may be led to imagine that it was glanced at in the censure in the Preface to this treatise, on certain "books written for children." Whether the form of dialogue is the best calculated for teaching a science; whether Mr. H.'s instructions are sufficient and in all respects correct; whether the easy and perspicuous example of that form of instruction (Mrs. Marcet's "Conversations on Chemistry," &c. &c.) since imitated by so many writers, has been by Mr. Hayter, or indeed by *any, successfully* imitated,—it is not the duty or intention of the author of the present treatise to give an opinion; but it is no less than justice to both parties, to declare, that the terms of censure alluded to, were by no means intended to be applied (nor can be made applicable) to Mr. Hayter's book.

It is curious to observe, that the one important line in the picture, where all horizontal distance terminates,—which contains the vanishing points, (and therefore determines the *direction* and *the length*) of all right lines parallel to the ground plane (except such as are also parallel to the plane of the picture, and of these the perspective *distance* one from the other is determined by it), —the line which in fact determines the *perspective of every point* in the picture, —the standard, as it were, of measurement and proportion of every picture that can be made, whether of landscape, architecture, portrait, natural object, single or grouped, large or minute,—should for ages have been so scantily noticed by so many writers, and so confusedly and inconsistently described by others, though all agree in their definitions of the term :—and after all, there is no difficulty in the theory.

The Theory of the Horizon-Line.

The horizon in nature is the extreme visible line bounding to the eye an indefinitely extended plane, which plane is a tangent to that radius of the earth on which the spectator stands. That plane is the *level* of the horizon ; and every plane parallel to it is called an horizontal plane : and every line contained in such parallel plane is called an *horizontal line*.

The ocean only marks the real horizon-plane out a lake, or flat land of indefinite extent, of which the boundary becomes invisible by means of its distance, terminates (as far as regards the eye) in the line properly called the HORIZON in nature.

The *perspective* of this line is, in the technical language of the books, called the principal horizontal line of the picture ; or briefly and more usually *the* HORIZONTAL LINE. In the present treatise "HORIZON-LINE" has been preferred, for avoidance of ambiguity of expression ; because *lines parallel to the horizon* (or *horizontal lines,*) are infinite in number ; and the words are of necessity and frequently made use of in that sense : and in like manner (and for the same reason) the term "HORIZON-PLANE" has been preferred to HORIZONTAL PLANE.

Of planes (imaginary or possible) parallel to the *horizon-plane,* the number is of course infinite : and such planes may be imagined on all levels, above or below the ocean in nature, and above or below the principal plane represented in the picture, and also above or below the eye of the spectator.

All visible flat surfaces, table-land, or the surface of a lake on a mountain, the surface of water in a pit, or the area of a pavement in an excavation, the

floor or ceiling of a building, a flat table, &c. &c.,—all are planes parallel to the horizon. So is the "plane of sight," or the supposed indefinitely extended horizontal plane which passes through the point of sight, which is the place of the eye of the spectator. Now the *perspectives* of the horizontal planes above or below the plane of sight, tend towards (or as it is technically expressed, "vanish in,") the *horizon-line.* (See Sect. XXIV.)

In every picture that is drawn from nature or imagination, whether it be the representation of a confined apartment, or of an open and extended view of nature, the delineation of the scene will depend on the altitude from which the scene is supposed to be viewed. Nay, even if it be a portrait, or a study of a head or a hand, or the sketch of an animal, or the delineation of an object on a table or floor, or on a wall or ceiling, the position of the object above or below the eye, and the greater or lesser distance of it from the eye, will determine its whole form and relative proportions, and the direction of all the lines of which the drawing is composed.

The imaginary plane in which the eye is placed, terminates, as has been said, in the *horizon-line* of the perspective: therefore that line must be marked or supposed in every picture; and on its position the whole of the perspective depends.

Now the books say, "the best proportion of a picture is when this line is at one-fourth or one-third (or some other proportional part) of the height of the picture above the base line;" that "it must never exceed such a height," and so forth: and the author of this treatise has maintained that the two proportions are independent of each other.

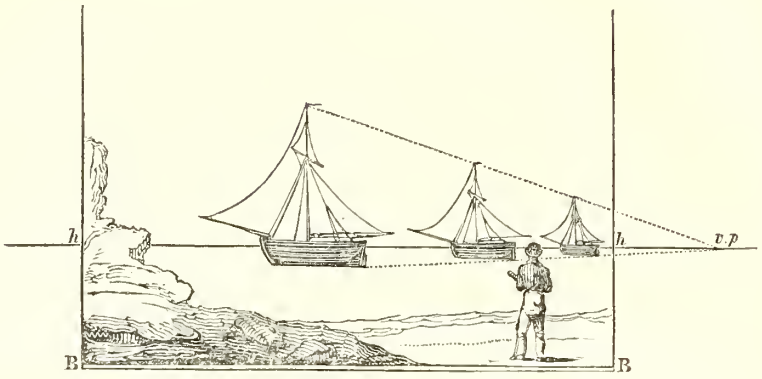
A picture may possess a *high* horizon (*i. e.* be truly drawn as viewed from an elevation high above the scene represented), and yet the horizon-line may be *near the base of the picture;* or it may possess a *low* horizon (*i. e.* as viewed from a low level) when the horizon-line is considerably *above* the base line.

Suppose a person placed at any greater or lesser elevation, casting his eye over a plane of great extent, (the surface of the sea will furnish the most convenient illustration,)—the line which divides that plane from the sky, is his *horizon-line:* and it will in the real scene appear to be, and therefore in a picture must be supposed to be, exactly on a level with his eye; *i. e.* in the plane of his vision. If he rises to a higher eminence, or descends to a lower station, this line will appear to rise or sink with him.

To begin with a station on a shore nearly flat. He looks over along the surface of the sea, and sees a tall-masted vessel floating light on the water.

(The deck of this vessel is supposed to be higher above the water than the eye of the spectator is.) Then the extreme line of the sea will cut the sides of the ship; as in fig. I.

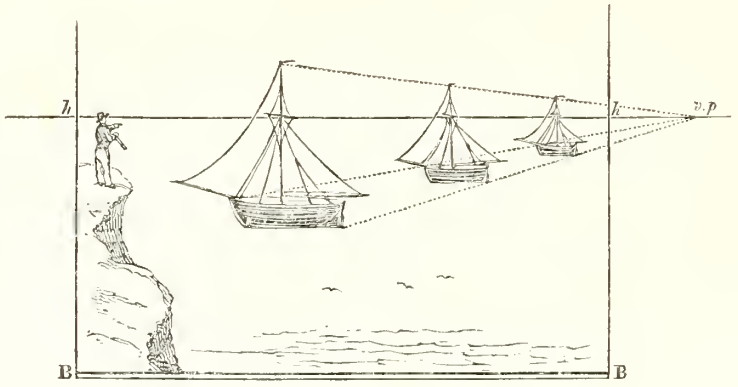
No. I.



and the gun-whale of the ship, as well as the masts, will intercept a part of the sky.

Let the spectator now rise to a higher station. He sees the platform of the deck itself. He sees the surface of the sea beyond it; and the line which divides sea from sky (his *horizon-line*) has risen with his eye, and now cuts the mast instead of the side of the ship.

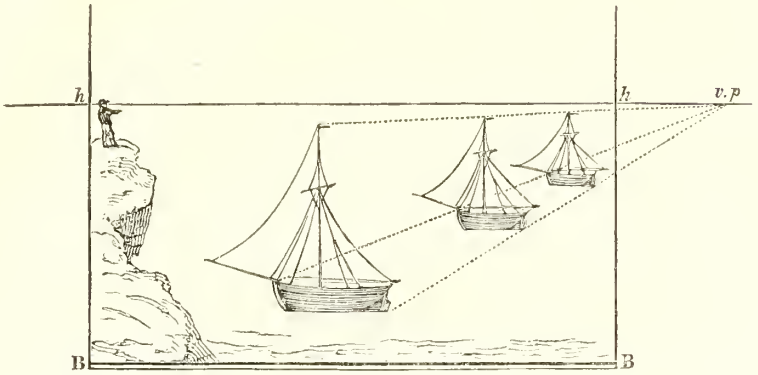
No. II.



Let him again ascend, and he will see the surface of the sea clear over the mast of the ship; and his *horizon-line* no longer cuts any part of it, but leaves a space, which must be represented in the picture between the utmost height

of the mast, and the line that divides sea from sky ;—the line in question,—the HORIZON-LINE of the picture.

No. III.



Now what becomes of the limitations in the books ?

If the horizon *is* high, it must be represented as high. It *is* above the mast of the ship, and it must be drawn as it is. The scene is viewed from a high level, and the horizon-line is, according to *all* definitions, a part of that level. Now it would be absurd to say that a painter must not represent any scene in nature viewed from an eminence ! May he not take a sketch from a high fortress, a cliff, or a mountain ? Say, "that it is difficult," and the observation is just. The cause of the difficulty will be considered presently.

A skilful artist, however, will overcome it in practice, and will not yield to the unnecessary prohibition. What is seen and admired, it is desirable to represent. What can be seen at one view *through* a transparent plane upright and directly before the eye, may be represented on a similar *opaque* plane (the plane or face of the picture). The image on the glass may be copied, and that copy would be a picture.

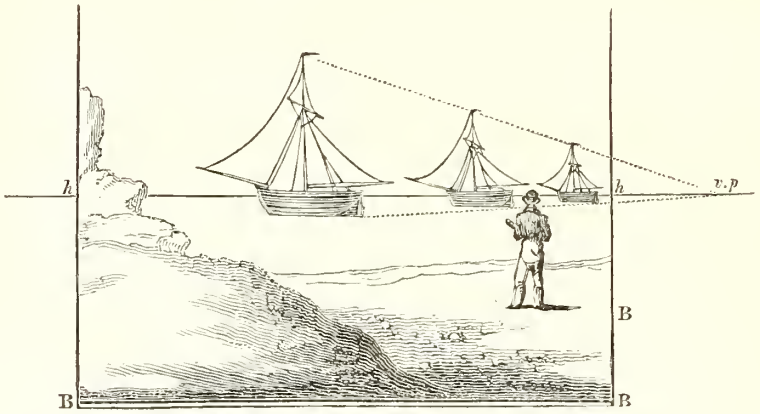
In the original landscape, water furnishes us with a constant level. The horizon-line must be *above* the furthest edge of any water beyond which flat land is, or may be seen ; or *at* that furthest edge, if bounded by the sky.

A spectator looking at Diag. I. is supposed to stand on a flat sea-shore. He sees the figure of a man standing on the same ground plane with himself, whose head reaches the horizon-line. The same line cuts the hull of the ship. In Diag. II. he is supposed to view the scene from an elevation ; and figures are seen in the picture on the same level with the spectator, whose heads also reach the line, which now cuts the mast of the ship ; and in Diag. III. where the elevation is still greater, there is an expanse of sea above the mast, and no ship or object touches the horizon-line.

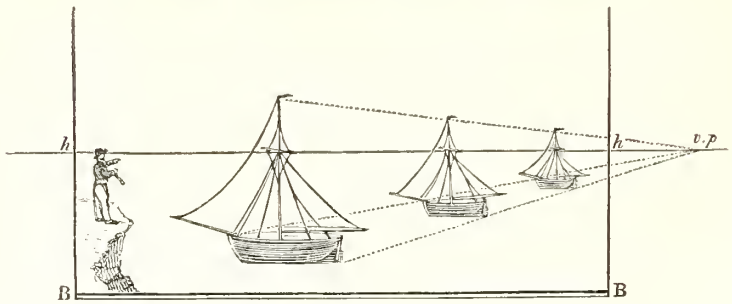
In all, a distant cliff and mountains might be put in beyond. In the first of the diagrams, (I.) the line of mountain would be low; and in the last, (III.) much higher: but in none of them would the perspective be disturbed, or the height of the horizon-line altered, by the introduction of high land beyond. The most distant visible line of sea would still represent it*.

A space of flat shore might also be introduced in the picture between the eye and the sea, by lowering the base line for the purpose. Neither would this affect the relative height of the mast, and the upper edge of the sea-line; neither will their relative heights be at all altered by cutting off the *bottom* of the picture, nor by raising or lowering the upper part, and thus cutting off, or adding to, the *sky*. Yet by such adding to, or taking off, the *proportion* which the height the horizon bears to that of the height of the picture, or to its width, will be entirely changed.

No. IV.



No. V.



* Suppose two cliffs of exactly equal height, with a channel of sea between them. The curvature of the surface of the sea would intercept from the eye of the spectator, on either of them, a portion of the upright cliff opposite; and on the supposition that it barely left visible the extreme height of it, the extreme visible line of sea would be exactly half way across the channel; but would appear to be distant by the whole width, and to touch the opposite land. (The refractive

This change of proportion, though it does not remove the relation of the horizon-line to the position of objects in the view, does greatly alter the effect of the picture. The increase of the space of foreground below the horizon, if well managed, gives the idea of greater expanse; (particularly if the representation of water touches the base line:) and, if ill managed, destroys the appearance of level, and gives the water, and objects on a flat, an appearance of rising like a ladder before the eye.

Thus a picture with a very high horizon as to perspective may leave, below the horizon-line, a very small space compared with either its height or width: and on the other hand, a picture may have a very low horizon, and yet there may be a large space of foreground below the horizon-line.

What then constitutes *high horizon,* as distinct from *low base,* or space below the horizon-line?

Answer.—When the eye of the spectator in the reality is high above the level of the principal horizontal plane represented, (whether the representation be of the distant part only of that plane, or of the nearer part only, or of both,) *that is a picture with high horizon.*

When the eye of the spectator is low, and near the level land or water, (whether the painter introduces much or little ground-plane below the horizon, *i. e.* near his feet or the point of station,) *that is a picture with low horizon.*

The *high horizon* is, when the *station is high;* the *low base,* when the *near part of the scene is introduced;* and this may take place on a perfect flat.

To recur to our pane of glass (Sect. I.) A man may stand on the plane himself, and by attempting to bring into his picture the ground near his feet,

power of the atmosphere is not here taken into account, but only the mathematical direction of the visual rays. The bending of the rays by atmospheric refraction will be noticed afterwards.) But if the relative heights of the two cliffs be unequal, the line of sea intercepting any part of one bank from the eye of the spectator on the other, will be nearer to the spectator on the opposite cliff, if his is the higher; and further from him if it be lower. He has no means of estimating this distance, unless he knows either the relative heights, or the height of one, and the length of distance.

The same will be, if he stands on some height equal to that of the mast of a distant ship, and can just distinguish the end of the top-mast over the line of sea. Then that horizon-line is half way between him and the ship. Another ship on that line would be visible in its whole vertical, from its water-line to the vane of the top-mast; and the small angle which that vertical line of ship and mast would subtend at the eye, is the difference between the height of the horizon-line, and that of the plane of the spectator's eye. It would be imperceptible in a picture, (as said in Sect. V. page 7), not exceeding the thickness of a pencilled line in a drawing, or perhaps a thread or two of the canvass in a moderately sized easel-picture.

If the surface of the ocean, or of an extended plain of land, were really flat, the distance would vanish imperceptibly, and no boundary between earth and sky would be visible.

he may produce in his picture all the bad (because unintelligible) effect of an extraordinary and ill managed high horizon; but he cannot bring in any object higher than himself, of which the upper part will not be above the horizon-line; whereas, when his base of station is high, high objects (such as the ships in Diag. III.) will be below the horizon, whether they be near or distant. In the first of the two cases, cutting off the bottom (or raising the base line) will bring the picture into ordinary perspective; in the second case it will only shut out so much of the representation, and alter the relative proportions of the height and width of the picture in its frame.

It will now appear, that the height of the horizon has no more to do with the height or width of the picture, than it has with the thickness of the wood frame in which the picture may be intended to be put. It may be placed at *any* height in the picture; nay, it may be supposed *out* of the picture; above the top, or below the base: but in the first case, the picture must be placed low, and viewed from above; in the latter, it must be hung high above the eye, and viewed near, and from below. The perspective will be *violent*, (as the phrase is,) but it may be made intelligible. Instances will be given of these cases.

The low base, however, must have its limit in degree and manner perfectly analogous to that of the field of vision (see page 9.); to which head it in fact belongs, though the discussion of it could not be introduced before the theory of the horizon-line was given; and it must still be postponed until a few words have been given concerning the position of the *prime vertical line*.

The field of vision is circular. It is the base of the cone of visual rays*, and the most regular and comprehensive form of a picture would be, a circle, of which the vertical diameter is the *prime vertical* line of the picture, and the horizontal diameter is the *horizon-line*. In this case the *zero point* will be the centre of that circle.

But such form of pictures is neither pleasing nor convenient, and therefore not usual. The painter then selects a part of it, generally quadrangular, and leaves out the rest: he cuts off a part of the top and bottom, and of each side.

Whether his quadrangular frame shall be square, or oblong either way, is a matter of indifference as to perspective, but will be decided by his taste or convenience, and adapted to the view he means to present; but *which portion* of the circle (the base of the cone of visual rays) he will inclose in his quadrangle, is a question belonging to our subject—Perspective.

* The eye is directed perpendicularly on the plane of the picture; and the sight comprehends a circle round that point. The visual rays from all parts of the circle and its contents meet in the eye, and thus form a cone; of which the apex is at the eye. This is called the *cone of visual rays*.

The part of the view in nature, to which he directs his eye, must be the point here called the *zero* point; it is where the *prime vertical* intersects the *horizon-line:* and, according to the system here insisted on, it should intersect at the centre of that line. On that head, it has been already said, some authorities are against us; and the dispute shall presently be entered into: but for the present it may be said, only, that the intersection is not necessarily, nor usually, in the centre of the *prime vertical.*

A term is wanting to express the *low base;* but before we propose such term, the predicament itself shall be more closely defined. It is, when the painter will delineate ground-plane near him, carrying down, as it were, the whole frame of his picture, and showing more of the lower than of the upper part of the circular base of the cone of visual rays.

The lower he brings it, the more different will be the perspective form of the objects and spaces in the foreground, from their true forms in nature;—the more violent and less intelligible the perspective will be: and therefore the judicious painter will avoid carrying it to a degree beyond his power of making it explain itself. The difficulty is exactly analogous to (indeed it is the same with) that pointed out in the chapter on the *Field of Vision.* He has enlarged too much the *vertical field of vision* by bringing the plane of the picture too near the point of sight; even though the *lateral* field of vision be at the same time narrowed by cutting off (or not extending) the lateral width of the frame.

But a paradox presents itself here. The extent of the *field of vision* consists in the *nearness of the point of sight* to the plane of the picture: and as the line of distance is perpendicular to that plane, it must measure from the nearest part of it; and this measure cannot be affected by relative proportion of width and height of the picture, or by the height of the horizon-line, or the lowness of the base. How then can it be said that the point of sight is too near, with respect to the *lateral* field, and not with respect to the *vertical* field; or, vice versâ, too near to the latter, and not to the former?

It is answered, that with respect to the *central* part of the circular base of the cone of visual rays, the lengthening or shortening of the line of distance has very little effect on the perspective. Look through a pane of glass, on a house or other object at a distance. Observe the magnitude and proportion of the figure it forms on the glass. Withdraw to a greater distance, keeping the object in the same part of the glass;—little or no difference will be perceptible. Withdrawing from, or approaching towards the glass (lengthening or shortening the line of distance), will exclude or admit other objects, but

will cause little or no difference in the appearance of the distant objects in or near the *centre;* but with respect to such as are wide of it, the magnitudes and proportions will be affected by the nearness, as has appeared in all the preceding problems and diagrams.

Now, to lengthen or shorten the line of distance, and to enlarge or diminish the picture from a fixed point of distance, is the same thing. A small plane near, is the same thing as a larger one proportionably distant. It presents to the eye, not only proportional, but *equal* objects; the picture formed *within the eye,* is in both cases equal in magnitude,—not similar, but identical. Therefore, the lowering of the base of the picture merely admits objects in that direction *in addition* to the former field, not varying the perspective of it. The widening of the sides would in like manner admit additional objects in *that* direction, still not altering the perspective of the central parts. Therefore, on determining the point of sight, we do not estimate the length of the line by actual, but by relative, distance; the proportion of the line of distance to the height *or* width (or height *and* width, both, or either) of the picture; to the length of the prime vertical line admitted within the supposed frame, or to that of the horizon-line within the same; to the portion of the circular base of the cone of visual rays selected by the painter, and admitted into his quadrangular picture, whether it be high and narrow, or low and wide.

As a term is wanting to express this *low base,* we shall venture to propose, "a broad *sub-horizon:*" and thus it will have been proved, that a picture may have a high horizon, and low base, (or broad sub-horizon) or the contrary. Diagrams IV. and V. (page 16.) are instances; and some further examples will be given in the succeeding plates. We now want a term to denote that part of the *prime vertical* which is *above* the horizon-line, which may therefore be called "*the super-horizon:*" and the picture may have a high or low *super-horizon,* whether the *horizon-line* be high or low.

The high or low horizon,—the broad or narrow *sub*-horizon,—or the broad or narrow *super*-horizon,—are three predicaments, each existing by itself, independent of the others.

It will be observed, though perhaps the reason may not be so obvious, that a high *super*-horizon is not so objectionable as a broad *sub*-horizon. The cause will be noticed in a following page, when we have to consider *why,* (when it is admitted that the *zero* point may be placed *above or below* the central part of the *prime vertical* line,) it is insisted that it must be placed in the centre of the *horizon-line.*

CHAPTER III.

Of the Position of the ZERO *Point.*

THAT point to which in the present treatise the term *zero* has been given, is in some called the point of sight; and in some "the centre of the picture;" and in some "the principal vanishing point." A reason has been given for refusing to adopt the first: as to the second, the vanishing points are infinite, and the word *principal* not evidently applicable to any one; and the third term is inappropriate, as the point is *very* rarely placed in the centre of the *prime vertical;* and though it has been here contended that it ought to be placed in the centre of the *horizon-line,* that is by some denied. At any rate, the point in question, is, the intersection of the prime vertical line with the horizon-line; and the question resolves itself into this:—Must *the prime vertical* line be placed equally distant between the two sides of the picture, so as to cut the horizon-line in two equal parts?

A considerable degree of latitude is allowed in this respect by some writers and by some painters. It is said by some writers, that though this "principal vanishing point" is called the centre of the picture, it is not always necessary to place it there: that it must be in the horizontal line, but may be nearer to one side of the picture than the other; and in fact, very many painters do so place it.

The principal reason given for it, is, that the centre of the picture will not always be the centre of the scene the painter chooses to represent; that the placing the centre of the scene in the centre of the picture would oblige the painter either to introduce, on one side, objects that are not picturesque, to the exclusion from the other side, of such as he wishes to introduce; or else, to enlarge his field more than is convenient; and instances are given of the practice of some old masters of high repute. With respect to the last reason, it may be put out of the question; for authority has no place in geometry. They may refer to *example,* and maintain that, notwithstanding the irregularity, the effect of the picture is fine; but still *if it is irregular,* however beautiful the picture may be, it is not PERSPECTIVE. It may be said that a certain known picture by Angelica Kauffman, in which (the legs of the figures being all naked, with open-sandalled feet,) one of the principal

figures has two right legs, is a fine picture: but it will not therefore be contended that "it is allowable" to draw a man with that deformity, because the painter thinks it will put his group into better form, and then quote the *authority* of that painter. What is a picture? It is a representation of what the painter sees or conceives. It is designed to communicate to the spectator, that scene, whether real or imagined, so that the idea of the artist and of the spectator may be the same.

If the painting is supposed to be that delineation on surface which would be described by visual rays passing through that surface to an eye placed in a given spot, and bent in a given direction, that spot and direction must be supposed and agreed upon. Without this convention, the painter has no means of securing the correspondence of the conceptions of the spectator with his own.

It must be agreed and understood, that in plane perspective the line of view is *perpendicular* to the plane: and it must be agreed (or in some way explained,) on what *point* in the perspective plane that perpendicular falls.

Mr. Varley illustrates this very well. He says, "the place *where the spectator views his own eye* (in a mirror,) is the point of sight, which is always in the middle of the picture." Though this is a very good illustration, few will agree with him in the reason he assigns for it; "because" (he says,) "no one would hold a frame or glass before him to see a view through, without placing it so that his own head should be in the centre." So far from it, it is probable that 99 times in 100, a man looks into that part of a large mirror that happens to be nearest to him. However, be that point where it may, the spectator must direct his sight to it perpendicularly: and where he sees his own eye, *there* is the centre of the *field of vision*;—of the circular base of the *cone of visual rays*. The line of sight is the axis of that cone, and its apex is at the eye of the spectator. Thus far the statement is invariable;—undisputed, and indisputable.

Now the painter must choose such portion of that field, above, below, or on either side, as will best answer his purpose according to his taste and intention, as has been said before; but then, it must be made evident to the person who views the picture, *which* portion that is. *His* field of vision, distinct or indistinct, extends equally on each side of that point; and therefore the perpendicular direction of the spectator's eye will naturally fall on the centre between the sides: and unless this is also the direction of the painter's eye, the same effect will not be produced in the imagination of painter and spectator.

A picture comprising any architectural structure, whether a cathedral or a cottage, will appear to be out of perspective, until it is evident where the point of sight (place of his eye) is; and although the spectator may have no knowledge of the subject, nor even understand what the term means, he yet must find the place where the perpendicular from his eye must impinge, before he can understand the picture. Till then he does not know the *direction* of the faces of buildings;—the upper and lower lines will not appear to be level, nor the sides of a rectangular structure, square one with another.

It is hoped this will be found evident on inspection of Plate XVI. fig. *a. b.* where columns are drawn with the same identical outline; but in one, the *zero* point (the intersection of the *prime vertical* with the horizon-line) is placed near the side of the picture; in the other, in the middle.

Fig. 2. and 3. give a representation of the same church, the zero point being displaced in one.

Instances may be found without number in the works of many artists—in drawings and engravings of streets, &c. &c.; and few persons can be unaware how different is the appearance of a scene when they first see the original, from the conception of the same previously formed in their minds from such engravings or drawings.

A convention then, is necessary between painter and spectator as to this *point*, where it is to be found; and unless some very evident means be adopted to inform the spectator where it is, he naturally looks to the centre, and is deceived as to the scene if it does not lie there.

But the plea above mentioned, viz. that "conformity to the rule, by causing the omission or introduction of objects that are desirable or otherwise, will produce disagreeable pictures," remains to be noticed, and we think may be easily answered.

The disagreeable effect may be obviated by a little change of *aspect* only.

In Plate XVI. a church is put in perspective in profile in a picture, of which the *zero* point is not the centre. The front of the tower, being at right angles with the sides of the church, must have all its vanishing points in the zero, which is placed near the side of the picture. The consequence is, that to the spectator generally, it appears out of perspective. The face and the side have not the appearance of being square with each other.

If the picture were continued on the right side so as to leave the *zero* point in the centre, it might occupy the painter in detail of disagreeable objects or uninteresting barrenness, or form a picture of unpleasing proportions.

Let him then, standing on the same spot, face a little to the left, and the

figure will present the same object, with the *prime vertieal* line, (and therefore the *zero* point), in the centre of the horizon-line. The difficulty and uncertainty of the spectator in understanding the perspective, is removed, and none of the objections are found to have place.

The lines of the sides and face of the building vanish in points more distant from the *zero*, because the whole stands obliquely to the plane of the picture, which plane was changed by the facing to the left. (See any of the plates representing oblique lines on the ground-plane.)

If it be now shown to the satisfaction of the reader, that the *prime vertical* line ought to be restricted to the centre between the sides of the picture, it will be asked, Why should not the *horizon-line* be also restricted to the middle between the top-line and base-line? Why must the prime vertical cut the horizon-line in its centre, and not be itself similarly divided? or, in other words, Why shall the painter be allowed at his discretion, to *raise or lower* his quadrangular frame in the cone of visual rays, and forbid to place it unequally as to one or other *side?*

It is answered, The spectator always perceives the position of the one, and not always that of the other line. He is always able to find where the *horizon-line* (or level of the eye) is supposed to be. It is above any visible face of water, or any thing that he knows to be intended for level ground. The perspective of any line really horizontal (but receding from the eye), *below* it, points *upwards*, and any *above* it *downwards*, towards it; and any such line being parallel in the perspective, is *in* the horizon-line. The spectator therefore directs his eye there at once; but with respect to the *width* of the picture he has no such guide, and therefore will previously suppose that he must direct his eye so as to divide the lateral field of vision equally: and in point of fact, always does so, unless some special reason offers itself for looking elsewhere.

Now it has been abundantly shown, that the *horizon-line* is fixed; that the painter cannot raise or lower *that;* but that the raising or lowering the quadrangular frame in the circular cone of visual rays gives only a broader or narrower *super-horizon* or *sub-horizon*. Further, the eye naturally draws a comparison between the two sides of a picture, but not between the top and bottom of it.

If, for instance, in any figure representing a number of squares on the ground plane, the quadrangular frame is laid so as to take in more on one side than the other, the squares near the foot of the side line on the right, present a very different form from those on the left; which being equally near the base, and equally near to the central point of that base, (in the same

latitude and *longitude,* Def. 16. 17. 19.) will be expected to correspond with each other in size and form. This offends the sight, and deceives the imagination; and although the *anamorphosis** is more *evident* in the comparison of the squares one with another, the case will *be* the same if any other objects be drawn in the foreground even of a landscape, and particularly buildings, or objects of regular forms. The perspective will be more violent on one side than on the other, at the same time that they present themselves in comparison and contrast.

Now the *super-horizon* and *sub-horizon* present no such comparison and contrast; the upper parts and lower parts of the picture have no such relationship. One is sky, the other earth; or one is roof, the other floor, &c.

There is, therefore, no necessity for dividing the *vertical* line in its centre, so as to make the *super-horizon* and *sub-horizon* equal; and the greater space of the two will be found generally to be given to the former;—to the upper part of the picture: the reasons for which it still remains to examine; and they appear to be these.

First, the greater part of the scene and objects that come within our view and engage our attention, are below the eye; and particularly such as are immediately near.

When out of doors, the landscape or continuation of the ground we tread on, is *principally* in our view, which we only *occasionally* direct to the sky. Within doors, in a chamber or in a public building, it is occasionally only that we direct our eyes to the ceiling.

We cast our aspect constantly and habitually, and to a much greater extent, to the right and left, than upwards and downwards, and therefore expect a much greater field of vision in a picture in that direction. Then, as *distinct* vision extends through a small space only when the eye is but little moved, (as has been shown before,) the vertical field of vision in the picture is more limited. But then this would confine the super-horizon as much as the lower portion, and would produce long pictures of small height; and probably the only (at least the chief) reason why this form is not more usually adopted, is, that in the upper part of the picture, such objects as do not require particular attention, are delineated: they are comparatively seldom in common life brought within the field of *distinct* vision, and therefore the difference between their perspective forms and real forms is less obtrusive. This is particularly the

* *Anamorphosis* is that appearance of distortion which is produced by too violent perspective; —where the perspective form differs from the true form in a degree which the eye is not accustomed to.

case in skies, where perspective is little thought of; and in the interior roofs of churches, or the ceilings of rooms, the imagination does not dispute the level. We *are* near the ground, and therefore the *horizon-line* of the picture (the level of the eye), is near the ground-plane: the field below that line (the sub-horizon), consists of objects *near* our *point of station,* but not on a *level* much below our eye. If we would comprise much of that, the plane of the picture is brought too near the eye; but the upper part comprizes objects that are on a level far above the eye, and yet not near: their admission then into the field of vision does not bring the plane of the picture too near.

If we make the horizon-line high, and attempt to introduce much ground plane, though it may be put in perfect perspective, it is not easy to comprehend it;—the flat plane appears to *rise;* and the reason will be found to be, that the eye is unaccustomed to the view. Habit is said to be a second nature; and so true is the adage, that we frequently mistake the one for the other; and in most languages the common people use the one phrase for the other,—"natural" for "habitual."

Let us contemplate a well drawn picture of the interior of a high-roofed cathedral. The horizon-line is placed at a small height above the base-line, and the *parallels of latitude* (Def. 19.) are very near each other. The upper line of the picture is very high above the horizon-line, and the *parallels* are very wide apart. If the horizon were placed high, the ground-plane would appear (at least to an eye unused to contemplate such pictures,) to *rise* like a ladder; yet the groined roof does not appear to *descend* in a like degree.

The difference will be more evident, perhaps, if we describe a long gallery with a flat ceiling;—the horizon-line being placed at not more than one-third or one-fourth of the height of the side lines (or of the *prime vertical line*) of the picture. Both floor and ceiling appear flat. Turn this picture upside down: let that part which did represent floor become ceiling, and the ceiling, floor. The perspective is as good as it was; but it represents a view as if taken from a gallery high and near the ceiling. Now it is probable, that for one view that we take from such a position, we practise 10,000 standing on the floor. We are therefore accustomed to the violently *descending* superior horizontal plane, conscious that it is really level; and the *ascending* inferior horizontal plane (see Def. 4. & 5.) is not so associated in our minds as to produce that consciousness.

In like manner, for one view that we have of sea from a high cliff, (always supposing the near part of the sea to be meant) or of low and level plain from a mountain, or from the top of a lofty tower, we have thousands and hundreds

of thousands of views of the ground we tread on extending from the eye forwards: and this fully accounts for the difficulty of representing, or of comprehending a true perspective delineation of a *descent* in the picture. The perspective line of the lower and distant part *is* higher on the plane of the picture, and therefore must appear to represent a higher object, until we can divest our imagination from the existence of the *surface* on which it is drawn, and penetrate towards the distance, (as we do when looking into a mirror, or through a pane); and until the actual height of position on the plane of the picture is conceived to represent *distance*, not vertical height. The rules for the correct *drawing of the lines*, it will not be difficult to collect from what has preceded in this treatise; but for the *effect*, the skill of the painter in distinguishing *distances* must give it.

Although this dissertation on these constituent parts of the picture proves longer than was intended, a brief addition by way of summary may tend rather to relieve, than add to, its prolixity.

The author trusts that he has made plain the following general system; viz.

That the field of vision consists of the circular base of a cone of visual rays from all objects that are present at once before the eye.

That the apex of that cone (the point where those visual rays meet) is at the eye of the spectator. It is here called the *point of sight:* and the *axis* of the same cone is the *line of distance.*

That the field of *distinct* vision, to an eye remaining *fixed*, is a small space round the centre of the circle; but extends in gradually, (and indefinitely), diminishing distinctness, in circles enlarging round that centre.

That that centre is the spot on the painting to which the line of sight is perpendicular.

That both the *horizon-line* and the *prime vertical line* must pass through it; and in fact that the intersection of these two lines, here called the *zero* point, constitute the central part of the true field of vision.

That the field of vision of the picture consists of such parts of the base of the cone as the painter chooses to include in the quadrangular or other form of surface he means to fill.

And, that the proportions of the picture are subject to the following rules —viz:

That the *line of distance* cannot, with good effect, be made less than equal to the diameter of the part of the base of the cone admitted into the picture, but may with advantage be made of greater length.

That the *horizon-line* is *fixed* by the position in which the painter is, or is supposed to be; and cannot be raised or lowered at his discretion, it being the actual horizontal level of the eye of the spectator.

That the painter may admit in his picture as much above or below the horizon-line as his taste and purpose require, *without regard to the proportionate form* and dimensions of the picture itself.

The increase of space below has been here called an enlarged *sub*-horizon, and that above, *super*-horizon: and it has been shown,

That the enlarged *sub*-horizon is more difficult (and more objectionable, as displaying more *anamorphosis*) than an enlarged *super*-horizon: but that when the original scene is viewed from a great height, the enlarged *sub*-horizon in the picture, well executed in detail and in keeping, gives greater appearance of expanse, but never can bring down high objects below the distant horizon.

But though the spaces above and below the horizon-line may thus be made unequal between themselves, it is here contended, (and it is hoped satisfactorily), that the spaces on the *sides of the prime vertical* ought to be equal between themselves:—that the painter cannot advantageously admit in his picture more on one side than on the other, but should so choose his portion of the circular field, as to leave the prime vertical passing through the centre of the picture.

The Author has not neglected the reasons given for dispensing with strict perspective in the field of vision by former writers, particularly by Kirby on Brooke Taylor,—by Varley, who vindicates panoramic views on a plane,—and Francis Nicholson, who, with Highmore and others, admit the *side* picture, (*i. e.* the exclusion of part of one side, as measured from the prime vertical and nominal centre of the picture;) but he cannot deem their reasoning satisfactory. The subject will be incidentally alluded to in the subsequent pages, and illustrated by some examples in the plates.

CHAPTER IV.

Of the Perspective of various Rectilinear Figures and Structures on Ground Planes divided obliquely.

So much of practical perspective depends on the truth of the representation of *oblique* lines, (which infinitely exceed in number both perpendicular and parallel lines,) that a facility of finding their perspectives is essentially requisite.

Further, as the innumerable intersections of right lines one with another form angles of an infinite variety of degrees, a facility of putting them in perspective is equally necessary.

The perspectives of *oblique lines* have never the same degree of obliquity as the originals; neither are they the same in different parts of the perspective.

Angles in perspective are never equal to their originals; neither is the perspective of any angle in one part of the picture equal to the perspective of the same in other parts of the picture. This has been, for the most part, made evident in the former part: but the practical rules may with advantage be carried further.

Of oblique lines, nearly enough has been said in Prob. II., and those then following. The *principle*, which is the key to every operation belonging to this system, (viz. the finding the *latitudes* and *longitudes* of the two extreme points, and joining them by a line,) has been demonstrated: but, to put all the points in their perspective places, would be like spelling every word we read: —having laid the foundation by a few points and lines, we look to the vanishing points to determine the locality, direction, and terminations of other lines.

In Prob. V. fig. 3. there is given a method of finding the perspective of a right angle, of which the two sides are oblique to the plane of the picture: and a further method (perhaps new in perspective) has been given in a few words in page 77, and in Plate XIV. fig. 1. & 2., of putting any angle in perspective: this principle may be conveniently extended.

It has also been shown (in page 53, and illustrated in Plate VII.) that if the two opposite sides of a rectangular figure be parallel to the base of the picture, (and therefore their perspectives parallel,) the two other opposite sides will be

meridians, (or meet in the *zero*) and the two diagonals will vanish in opposite points in the horizon-line.

If the rectangle be equal-sided, (a square), these two opposite points will be the two *measuring points* (Def. 26.): or if the *sides* of the square vanish in the measuring points, one *diagonal* will run to the zero, the other will be a *parallel,* (*i. e.* parallel to the base:) but it might have been added, that if *neither* side *nor* diagonal of the parallelogram (whether equal-sided or not) runs to the *zero,* (*i. e.* if the whole figure be oblique to the plane of the picture) two parallel sides will vanish in some point in the horizon, not the *zero* nor *measuring point,* and the two others will vanish in some point on the opposite side of the zero. The two diagonals also will vanish on opposite sides of the zero, but not on the measuring points.

There will be four vanishing points;—one for each diagonal, and one for each pair of opposite sides; see fig. 1. & 2. Plate XVII.: and since all different degrees of obliquity will give different vanishing points, it may be convenient at least to give some additional rules for finding them.

In Plate VII. diagrams are given in which the whole ground-plane is divided into squares, with sides parallel to the base, of which the *diagonals* vanish to the measuring point (*d*) of the picture: and squares of which the diagonals are meridians, and the *sides* vanish in the measuring points.

The obliquity of these is 45° or half a right angle; but a figure ought to have been given representing a ground-plane divided into squares of other degrees of obliquity; to which we shall now proceed, but shall premise the following proposition.

If, from the two extremities of the base line of a picture, lines be drawn to the two opposite measuring points (usually in the foregoing diagrams marked *d d*) they will intersect each other in the picture, and form the perspective of a right angle, (or of lines perpendicular to each other) as has been abundantly proved.

Now because lines that vanish in one and the same point, are the perspectives of lines parallel to each other, and because lines parallel to each other must *all* be perpendicular to any line to which *any one* of them is perpendicular, therefore any line drawn through any part of the picture from either of these measuring points, must be the perspective *parallel* to that of any other line so drawn, and *perpendicular* to any line drawn through the picture from the *opposite* measuring point.

(The reader will easily construct this diagram for himself, and therefore the plate is not further filled by its introduction.)

Thus far, of right angles: and the same reasoning will apply to angles of any other degree; for, as lines proceeding from *any* vanishing point are the perspectives of lines parallel to each other, they must have the same degree of obliquity on any line, or any number of parallel lines; or (in other words) must form the same angles with them.

As the possible degrees of obliquity are infinite, one position only must suffice, and the analogy be pointed out by which the perspective of all other degrees may be found.

Problem XXIII.

To put a Rectangular Quadrangle in Perspective with its sides oblique to the Plane of the Picture, but at a lesser or greater angle than the half right-angle.

The quadrangle being drawn on the geometric plane, it may be put in perspective by Prob. VII. and the vanishing points of the sides marked as in Prob. VII. Plate III.: but in order to determine the angle and the obliquity more readily,

Taking any part of the base line as a diameter, draw on the geometric plane a semicircle;

as in Plate XVII. fig. 1. (in this diagram the *whole* base B B is taken as the diameter.)

from one end of that base line, draw a line to meet the semicircle at any point according to the degree of obliquity intended; and from the other end of the same base (which mark, 3) draw another to the same point, and call it 1.

That will be a *right-angle* at whatever point the first line meets the circumference. See Chapter on Practical Rules, page 77, and Plate XIV.

Find the perspective of 1 by Prob. I. and mark 1 there also.

From each end of the diameter of the semicircle on the base, draw lines in the picture meeting at 1, and they will form, with the base, the perspective of the original triangle B. 1. 3.

Prolong the two sides each to, or towards the horizon-line.

(In the diagram, the perspective line B 1 tends to a vanishing point beyond the picture, and therefore its vanishing line is left indefinite: 3 1 meets the horizon-line within the picture.

If one side is at the obliquity of 45° (or half the right-angle), the other will be the same; the two will meet in the semicircle on the ground plane, dividing

it equally; and in the perspective the prolongation of the two sides will vanish at the opposite measuring points, *d.*

If one is more than 45°, the other will be less. (Those in the diagram are about 60 and 30; the two will always amount to 90.) The vanishing line of the first will reach the horizon-line nearer to the *zero;* that of the other at a greater distance.

If that distance is out of sight, omit the distant part of the vanishing lines.

Hitherto we have got the perspective of one angle only, and two undetermined sides of the intended figure. If it is intended to be equal-sided, (a square), measure on the longest side of the original, a portion equal to the shortest side, reckoning from the point 1,

and call the point 2.

draw a line from that point to the point on the base from which the shortest side springs,

and mark that point 3. (the line 2. 3. is dotted.)

Now we have 3. 1. 2. an equal-sided right-angled triangle, which is half a square, of which 3. 2. is the diagonal (or hypothenuse).

Put the point 2. in perspective by Prob. I.

and mark that point 2.

(The quadrant and radii are omitted in the diagram to avoid multiplicity of lines. It will be sufficient to lay the edge of a ruler or a strained thread, merely to find the points of intersection.)

Draw a line from 2. (in the perspective) to the vanishing point of the shorter line (or 3. 1.)

This point, which is on the *right* of the zero, is marked *v. p. r.*: the longer and indefinite line runs to the *left*, and is considered to vanish at *v. p. l.* out of the picture.

Now one side of the proposed figure is on the vanishing line 1. *v. p. r.*, and the other on 2. *v. p. r.*: and it remains to find their terminations.

Draw a line from the original base line at 3. to the perspective point 2., which will be the perspective of the dotted line 3. 2. of the original; this also is dotted. We may then bisect the original line 3. 2. and call the bisection *b.*—draw its line of incidence, and its *meridian* line will bisect 3. 2. of the perspective; mark *b* there, and from it draw a line through 1.; and where it meets the horizon-line, is the vanishing point of one diagonal:

which mark *dia. l.*

Draw another line from 2. to the same point, and where that intersects 1. *v. p. r.* it terminates that side of the square; there mark 3.

In the diagram these last lines are dotted, and the point is marked *dia. l.* as being the vanishing point of the diagonals towards the left.

Then a line from 1. through the same centre, will be the second diagonal, and will cut the last line (2. *v. p. r.*), there mark 4, and join 3. 4.; and 1. 3. 4. 2. is the square wanted; 1. 4. is the *diagonal* vanishing to the right; 2. 3. is the *diagonal* vanishing to the left.

1. 3. and 2. 4. are *sides* vanishing to the right; and 4. 3. and 2. 1. are *sides* vanishing to the left.

This is the perspective of a square as if described on 1. 2. in the original, but which it would be unnecessary to draw on the geometric plane.

Let it be observed that the semicircle drawn on any *part* of the base would answer the same end, only it would be on a smaller scale; and it will be seen that when the perspective of the point 1. (the apex of the angle) is found, lines drawn from the extremities of the diameter (or chord) of the semicircle meeting at the perspective point 1., will form the perspective of a right angle; and if the arc described be *less* than a semicircle, lines from the extremities of the chord meeting in any point on the arc, will form an angle *greater* than a right angle.

If the original base be the chord of an arc of one-fourth of a circle, or 90°, the angle formed anywhere within it will be of 135°, or two sides of an octagon. If of one-sixth (or 120°), it will be 60°, or two sides of an hexagon. Vertical lines erected on the angles will comprise the sides of eight-sided or six-sided buildings.

Perhaps the following method of performing the same operation may be preferred.

Problem XXIII. varied.

From any part of the base of the picture draw a line on the geometric plane, at the intended degree of obliquity of one of the sides of the intended figure, and call the termination of it I, and the point on the base 2.

From the same point on the base, draw another line diverging from the first at any angle desired.

In the diagram this is made a right angle; and being intended for the sides of a square, the legs are made equal.

Mark the termination of this second line, 4.

(The points are so numbered, to correspond with the last figure in the perspective.)

Put the points 1. and 4. in perspective (2. is the perspective of itself, being on the base line; it is a point in the original and in the picture.)

Draw the line 2. 1. in the perspective, and also 2. 4., and they form two sides of the square. The prolongation of the first vanishes to the left at a distance, and that of the second to *v. p. r.*

Draw a line from 1. to the same point, and a part of that line will be the opposite (third) side of the square.

Bisect the original 1. 2. at *b*, and find its perspective, which mark also *b*.

Then because a line from *v. p. r.* cutting 1. 2. any where, (see fig. 2. in next plate,) will be a right-angle; it will form a right-angle at the bisecting point *b*, and of course will pass through the centre of the square, and be parallel with the side 2. 4. and its opposite.

Now we know that a line from 4. to the vanishing point of 2. 1. would cut the third side at its desired termination, and would itself be the fourth line parallel and opposite to 2. 1., but that vanishing point is beyond our reach.

Draw then a line from 1. to 4., which will give the diagonal vanishing to the right, and will also cut the line *b.*—*v. p. r.* at the point, which is the centre of the square.

Lastly, draw the other diagonal through the centre, which will vanish on the left in the picture at *dia. l.* Where it cuts 1. *v. p. r.* mark 3.; and 1. 3. 4. 2. is the square, as in the figure 1. but larger, as being nearer the base of the picture.

Problem XXIV.

To Divide and Subdivide the whole or part of the Ground-Plane into oblique perspective Squares, equal to the given oblique perspective of any Square.

A square being given (as 1. 2. 3. 4. Plate XVIII. fig. 1.) in order to multiply it, prolong the four sides each way; two of the sides will reach the horizon-line within the picture,

as at *v. p. r.*

the other two will converge on one side

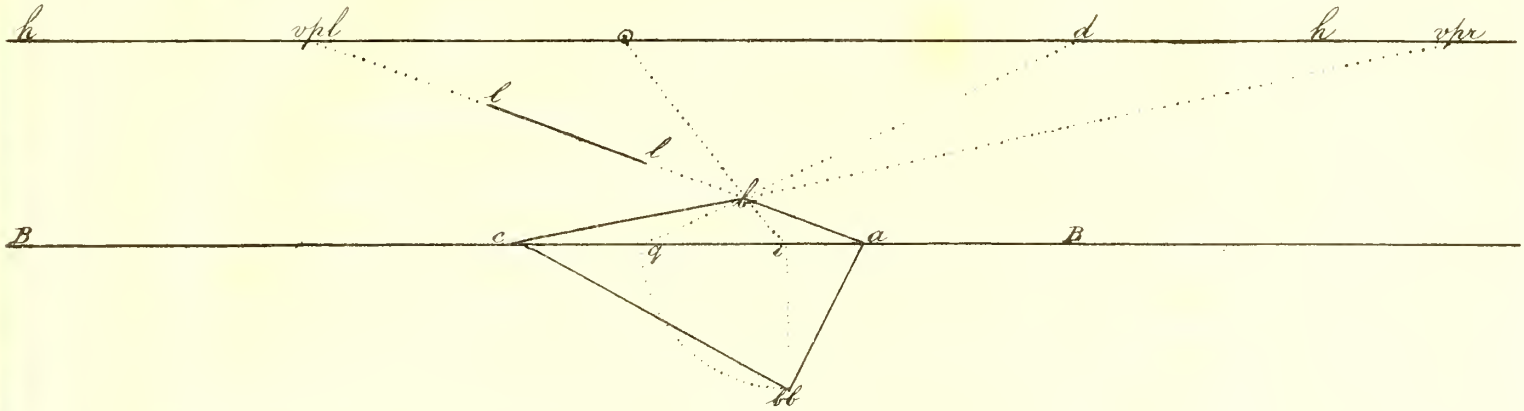
towards *v. p. l.*

and will diverge and be lost on the other side.

towards *dia. r.*

To follow Problem XXIII.

Amateur's Perspective Supplement. to face page 24.



It is a frequent desideratum in practice, to find the direction of a line at right angles with one already drawn by the eye, or from imagination, with any accidental degree of obliquity.

Draw as usual the base line BB; the horizon line hh; the Zero o; and the side distance d, (which in this instance is placed very near, in order to reduce the diagram.)

Draw the accidental line l.l. in any part of the picture.

Suppose this line prolonged to the horizon line; and where it reaches it, mark vpl. (if the line points upwards to the left, it will be vpl.)

Suppose it also prolonged to the base, as at a.

Now in order to find the vanishing point of a line which will cut it at right angles, assume any point in the prolongation of this line, and by Prob: 1. (inverted) find the original of that point, — thus,

" From o draw a line through the point to the base, (that will be its radius;) mark i as the point of incidence, — from that draw a line perpendicularly downwards on the geometrical plane, which will be the line of incidence, (dotted in the diagram.) —

" From d, (the side point of distance) draw another line (dotted in the diagram) and it will find the quadrant point q. — Draw the dotted quadrant, which will find b.b. the original of b. —

" From a draw a line to b.b., and at right angles with that, draw a line to the base at c. —

" In the picture, join c.b. which must form with a.b. the perspective of the right angled triangle a. bb c. on the geometric plane. —

Then c.b. continued to the h line, will find the vanishing point, vpr, which will give the right angle to the accidental line l.l., or to any line vanishing in vpl. —

Prolong one diagonal to its vanishing point in the horizon-line,

as at *dia. l.*

From that point (which is the vanishing point on that side of the diagonals of all the squares sought,) draw lines through each of the other angles of the square, viz. 1. and 4., which will be diagonals of the adjacent squares: and where those lines intersect the prolongations of the sides 1. 2. and 3. 4., draw vanishing lines to the vanishing point of the other two sides,

viz. *v. p. r.*

and these last will be the sides of the adjacent squares sought.

(This follows so evidently from what has gone before, that a verbal demonstration would be superfluous.)

In the same way the next adjacent squares may be constituted; and thus the whole ground plane be divided into equal contiguous oblique squares.

In order to subdivide them,

draw their diagonals; and through their centres draw vanishing lines each way,

as in the same diagram.

And thus each square may be *sub* and *sub*-divided as far as desired, upon the principle of subdivision, shown page 78, and in Plate XIV. and fig. 3. and 4.

The reader will have observed, that a line from the vanishing point of the two sides 1. 2. and 3. 4. passing through the centre of the square, would bisect the other two sides, and divide the square equally into four parts; but when one side of the square is put in at an obliquity of more or less than 45°, one of the vanishing points may be too far off to be practically convenient, which is the case here with *v. p. l.*

Also if the sides of the square, or its diagonals were *parallel* to the base, vanishing lines from equal divisions on the base would divide the ground plane into equal portions, as in Plate VII. fig. 2. and 4.; but when they are both oblique, the perspective divisions will not be equal. In this case it becomes more convenient to work from the two vanishing points that are within reach.

The use of a ground-plan divided into the perspectives of equal squares has been shown before, page 77; and since any part of it may be chosen for the width, length, and direction of the ground plan of any rectangular building, the vertical lines erected on it will give the visible faces of the structure; and vanishing lines from those vertical lines at any height that may be drawn, will give the perspective of any superior or inferior horizontal section of such structure, as well as of all horizontal lines on their vertical surfaces, of which

some figures are given in the same plate: but first we must say something more on the practically useful system of the perspectives of angles, and the vanishing points of their sides.

It has been shown that lines drawn from the two extremities of the chord of any part of a circle meeting in the arc, will give a certain angle at whatever part of the arc they are drawn to; and that if that arc be a semicircle, they will give right-angles,—if more than a semicircle, acute angles,—and if less, obtuse. The reader may easily make a scale for himself, if wanted, showing what would be the angle so given on the chord of any given portion of the circle: but, (not to multiply diagrams or words here) it shall be merely stated, that the angle so formed in the arch of the semicircle will be a right-angle, or two sides of a square: on the arc of one-third of a circle, those of an hexagon; of a one-fourth, those of an octagon. These are the angles of the most usual buildings; as towers, windmills, &c.

If, therefore, any such portion of a circle be drawn under the base line (or any part of the base line) of the picture, as in the foregoing fig. 1. Plate XVII. such angle may be put in perspective in the same manner as the right-angle there: and the vanishing points of the two sides being ascertained in the same manner, the desired angle may be found at any point desired on the perspective ground-plane, by drawing lines from the two vanishing points, meeting at that point.

Thus, in Plate XVIII. fig. 2., the angles so formed in different parts of the picture are the perspectives of angles equal to each other, and to the angle first put in; which might have been of any degree desired, and have represented two sides of an octagon, hexagon, or any other form.

It will further be observed, that if these lines are made not only to meet, but to cross, they give the perspectives of four angles, of which two opposite ones will always be more obtuse, and the two intermediate opposite ones will be more acute, than those of the original: but the sum of the four will always be equal to four right-angles.

Now if a vertical line be erected on any of these points, the two sides formed by the lines from the vanishing points will serve for the ground plan of two *exterior* sides of a building, or the two other lines may represent that of the two *interior* sides.

Fig. 3. is so constructed, representing the two exterior sides of a square castle. Fig. 4. the two interior sides of the same: and fig. 5. the same, of a domestic apartment, as a library.

x is the same angle in each of the three figures.

The first vertical being set up at the height desired, viz. on the point *x*, gives the principal line: (it will be the *nearest* if *exterior*, the *furthest* if *interior;*) and lines from the top, vanishing to the same points as those of the base of the building, give the terminations of the two other vertical lines placed at will on the ground plan, and thus form the two sides.

In the representation of the *exterior*, the vanishing lines, both from the top and bottom, run to the horizon-line on *their own sides*. In that of the *interior*, they run to the vanishing point on the opposite side.

If the structure is not intended to be represented with upright sides, as for instance if it be an obelisk or pyramid, the perspective form of its upper horizontal section must be first put in at its intended height, and the sloping sides will be formed by right lines joining the top and the base.

Problem XXV.

To put in Perspective the upper horizontal section of a Prism or Pyramid, with reference to the section of the same on the Ground-Plane.

Let the ground plan of a square structure be put in perspective,

as 1. 2. 3. 4. fig. 8. in same plate.

Find the centre by the diagonals, and prolong the two nearest sides of the square (for the other two will be hidden when the sides of the building are raised,) to, or indefinitely towards their respective vanishing points; and the diagonals in like manner.

2. 4. in the figure vanishes (like those in the former diagrams) to *v. p. r.*, and the dotted diagonals, 2. 3. to *dia. l.*

On the nearest point of the base of the building, (2. in the diagram) erect a vertical line of the required height, and call the point above, 2 also. From that height draw the vanishing lines towards the same points as those of the base:

viz. 2. 4. towards *v. p. r.*, and 2. 1. towards *v. p. l.*

Now a vertical line from the more distant point of the base (4. in the diagram) will terminate where it reaches the first vanishing line above:

mark that also 4 above.

Raise a vertical line also on the other nearest point, 1, which will terminate at the other vanishing line of the 2. above: but if the vanishing point is out

of reach, draw from 2. above to *dia. l.* (the vanishing point of the diagonal of the base 2. 3.), which will give the upper diagonal corresponding to it.

Raise a vertical on the central point below, which will cut that upper diagonal at its central point; and a line from the upper 4. through that centre will give the second diagonal, and cut the vertical line 1. at its proper termination, 1. above.

> Now a vanishing line from 1. to *v. p. r.* will cut the vanishing line 2. *dia. l.* at 3., and 1. 2. 3. 4. will be the upper horizontal plane or section corresponding to the square base on the ground-plane.

This will be the outline of a square building with upright sides, the top of which is parallel to the base, and of equal magnitude.

Fig. 8. represents also an intermediate horizontal plane, constructed in the same manner as the highest plane. The lower side of the two upper planes is shaded to distinguish the superior from the inferior horizontal plane; the latter being left light*.

If the design is to represent a pyramid, or building narrowing at the top, still terminating in a square, we may put the smaller square on the ground plan within the larger square, and find one at the top, equal to it and directly over it, corresponding centre to centre and side to side; and then, instead of vertical lines, draw sloping lines from the angles on the ground plan to those of the upper square.

To draw the perspective of a smaller Square within a larger one on the same Centre, and with its Sides parallel.

The larger square being given, as at 1. 2. the lower line, (in fig. 6.) and 3. 4. the upper, the square being oblique on the plane, as in the two last figures; and the diagonals being drawn, place the first point (*i. e.* the apex of the nearest angle intended) on the nearest diagonal, at such distance from the angle of the outer square, as will decide the size of the intended inner square: call that point *b*.

One side of the intended inner square will be the vanishing line of *b* towards *v. p. r.*, terminating on the other diagonal: call this point *d*.

* The apparent violence of the perspective of this figure will disappear if the eye be brought *very* close to it.

Now lines from *b* or *d* towards the vanishing point of 2. 1. and 4. 3. will cut the diagonals at the two other points of the intended inner square, which points are to be marked *a* and *c*: but when the last vanishing point (*v. p. l.*) is too far to be of use, a method must be used for guidance of the vanishing lines, which will be given in the next problem. In the mean time we proceed on the supposition that the point *a* or *c* is found: and then a line from the vanishing point of 2. 4. or *b. d.* (i. e. *v. p. r.*) through the one will cut the diagonal, and mark the place of the other.

Then *a. b. c. d.* is the inner square.

Problem XXVI.

To put in Perspective a Pyramid on a square Base, the Base being given on the Ground-Plane.

From a perspective square on the ground plane.

By means of the diagonals find its centre, and on that centre erect a vertical line to the height intended. Raise sloping lines from the corners of the square to meet at the central vertical line, and they will complete the outline of the pyramid.

If the pyramid is to be truncated, flat at the top, let the two (*i. e.* the outer and inner) squares of the last problem be given as the base of the intended structure,

as in fig. 6.

Raise vertical lines on *a. b. c. d.*, the angles of the inner square, and find the corresponding upper square, as was directed in the last problem.

Then raise lines from the corners of the outer square below to those of the smaller square above, which will be the outlines of the intended truncated pyramid.

as in the same figure.

But as only two sides of a quadrangular solid structure can be seen,

viz. *a. b. d.* at the top, and 1. 2. 4. at the bottom, another figure (7.) is given to represent the solid structure completed.

In the description of fig. 6. it was wanted to place one of two certain points, (*a* and *c*,) which it was known would be on two certain lines (the diagonals

of a square) where the vanishing lines of two certain points would cut them; and it was known that those vanishing lines (*i. e.* the vanishing lines of *b.* and *d.*) were the representatives of two lines parallel to the two known vanishing lines of 1. 2. and 3. 4.; but their vanishing point was too far off to measure from. Now it must be observed, first, that although it is *expedient* rather to work by vanishing lines than to resort to the longer method of finding individual points wanted, it is not *necessary;* for we might *spell* the problem, (see page 29.) and put in the point wanted by Prob. I. It is, however, highly expedient to be furnished with means of determining the direction of any line of which the vanishing point is too distant to measure from. The principle is, to find where it will intersect the side line of the picture. One method is given by Kirby,—two or three by Highmore,—one by Peter Nicholson,—and some detail on the subject by Edwards: some of these are very intricate, and some not very intelligibly explained. The reader may find some entertainment in inventing methods for himself; but it is hoped the next problem will assist him, and perhaps be found to be more simple than any of those alluded to.

Problem XXVII.

To find the Points on the side line of a Picture, which will be cut by lines vanishing to a point out of reach.

If two lines vanishing in the same point are already known, prolong such two lines through the side vertical line of the picture. Measure the distance between the two points they cut, and divide that distance into any number of equal parts: draw any other vertical line that shall cut the same two lines any where, and divide the portion of such vertical as lies between those lines into an equal number of equal parts (which of course will be larger than the divisions on the side line). Now new lines drawn from the divisions on the last vertical, through the corresponding divisions on the side line, will vanish with the two known lines; and of course will represent lines parallel to them: and will also give the perspective parallels from any intermediate point through which they pass. (See fig. *x*, in Plate XIX.)

This is the principle of Kirby; but it is not in all cases, nor indeed generally, easy of application;—besides it requires that two lines shall be known. The following method is therefore proposed.

Draw the *horizon-line* of the picture *h. hl.* fig. *z.* (*hl.* being the *left* side).

Place a point *o* any where in the picture, and draw a line which shall represent the known vanishing line of that point to the side-line,

as *o.* to *v. o.*

Let *a* be the point whose vanishing line is sought.

Draw a vertical line from that point to the horizon-line:

it is dotted in the figure.

Prolong the known vanishing line of *o* till it intersects that vertical line:

the prolongation is dotted in the figure.

Now as the portion of the new vertical line from *a*, intercepted between the prolongation of the known vanishing line and the horizon-line at *h*, is, to the portion of the side line intercepted between the known vanishing line and the horizon-line on the left, so is the whole of the vertical line from *a* to *h*, to the portion of the *side-vertical* sought: and, to find this proportion, use the method given by the right-angled triangle, page 78, and Plate XIV. viz.—

Take the height of the first-mentioned portion of the vertical line,

viz. the dotted line *o. h.*

and lay it down as the base of the triangle,

as *o. k.* in the triangle A.

Take the height of the known portion of the side-line, and set it up vertically at the end of the said base,

as *k. kl.* (equal to the portion of the side-line between the *known* intersection and the *horizon-line* on the *left.*)

then draw the *hypothenuse*

o. p. l. in the triangle;

and prolong both the base and the hypothenuse indefinitely for a little way.

Now measure in the picture the whole vertical line from *a* to the horizon-line, and cut off the prolongation of the base of the triangle to that length, measuring from *o*,

as *o. v. a.* in the triangle.

Then a vertical line from its extremity to the prolongation of the hypothenuse at A, will be the length of the line to be applied to the side of the picture, where it will mark the intersection wanted, measured from the horizon-line.

as *v. a.*, *h. l.* in the figure *z*.

The two other triangles B and C, are formed in the same way from the points *b.* and *c.* in the picture, and marked *v. b.* and *v. c.* on the vertical side-line.

The principle and the detail will be exactly the same, if the points are placed *above* the horizon-line. Let the vertical line be always carried to the horizon-line, and the measures taken from it.

In Plate XVI. figure 1. on the right side at bottom, the column *a* is a drawing reduced from Plate XXXVII. of Pozzo: and if considered as a picture by itself inclosed in the frame marked, it will probably strike the eye of a spectator as being distorted: *b* is intended to be a tracing of the same reduced figure, in all respects similar; but it is placed on the left side of the frame or picture in which it is contained, and of which picture the *zero* point is in the centre. The spectator will probably perceive the truth of the representation here, though the same outlines *a* showed distortion when otherwise situated. (The remaining part of this picture (*i. e.* fig. 1. *b*.) will be referred to in another place.)

Fig. 2. represents a church, of which the sides are parallel to the plane of the picture, and the faces of the tower, &c. perpendicular to it. It occupies what might most properly be called *half* a picture; the *zero* point being placed on one side, and the other half of the picture omitted.

The *line of distance* of the spectator runs perpendicularly to the base of the picture near one side,

in the direction of the arrow-point *z*, and another line is then drawn in the direction of the arrow-point *y*.

If the spectator were to face a few degrees to the left,

in the direction of the latter line,

the plane of his picture, (being at right angles with his line of sight,) would be brought down to B on his left; and the object (church) would be in oblique perspective in the centre of the picture, while the picture would remain of the same size and proportion, and on the same scale,

as at fig. 2.

The *zero* would be in the centre; no distortion would appear; the angles would not appear obtuse; the representation would be in a more pleasing and picturesque form; and the objections usually made (see page 21 and 23) would be obviated.

It is true that the small obliquity of view gives the artist more trouble; but beside the getting rid of a degree of apparent distortion at the angles, is not the effect of lines converging in different degrees always better than that of a number of parallel lines on the profile of a building? Shield, the musician,

says (in a treatise on musical composition), that the marks used to denote the repetition of preceding bars often induce the composer to content himself with the sameness of a continued base or middle accompaniment, which, if he had been obliged to write every note, he would have varied; and it may be suspected that a similar feeling will sometimes induce an artist to choose such an aspect for the plane of his picture as will save him the trouble of thinking of, and comparing the convergencies of his vanishing lines.

Francis Nicholson (in his useful book, entitled "The Practice of Drawing and Painting Landscape," says, "the centre of the picture is in the horizontal line, but it is not necessary that it should be equidistant from the ends: the artist frequently places it nearer to one end than the other, when he would reject a part of his subject at either end of the view." Francis Nicholson's opinion, as a man of taste as well as skill,—as a man of science as well as an admirable imitator of the finest effects of natural landscape and general scenery,—is entitled to respectful attention: but perspective was not the subject he was principally treating of; he professes only to introduce a few practical hints. Now it may be questioned whether,—if he were to make two drawings for pictures of the same subject, on the same scale, from the same point of view, the one with the centre (as it is called), not in the centre of the frame, and the other with it so placed, either by means of the change of aspect as described above, or by enlarging the picture on one side, and filling up the foreground so as to hide scenery he wished to exclude,—he would not, with the two before his eyes, generally prefer the picture with the centre truly placed. Where a picture is made for a particular place, (as on a staircase, or the side of a gallery,) and which cannot be seen but in a direction perpendicular to the point in question, that is out of our present rule,—the picture explains itself, and that is all that is required.

CHAPTER V.

Of the Base of the Cone of Visual Rays.—Of Levels above and below the Eye.—Of the Appearance of Descent.—Of the Appearance of great vertical Heights.—Of Anamorphosis.—Of Reflection and Refraction.—Miscellaneous Hints and Practical Directions.—Conclusion.

Plate XX. represents a view comprised within the circular base of the cone of visual rays meeting in the eye of the spectator (see note to page 18); the spectator in this case being placed at a considerable height. It is a view down the Rhine from the castle of Schlosberg, and is intended to illustrate the principles of *high horizon* and enlarged *sub*-horizon together.

The foreground (1) is near the station of the spectator, and very high. The second distance (2) is near, and at a depth below: 3, on one side of the picture is flat land, and on the other side rising wooded rock. The figures 4. 5. 6. 7. 8. denote the different distances. At 7, in the centre of the picture, is a faint distant view of Coblentz, which the river visibly passes, and divides from the fortress of Ehrenbreichtstein on the right bank. The river, being visible a little beyond Coblentz, shows that the horizon-line is a little above it: 7 is rising hills beyond; and lastly, 8 is blue distant high land.

If the painter does not choose to include so much, he may take off from the *sub*-horizon, and draw the base of his picture through 3. and 4.; but then by omitting the near part of the low level plain and river, he loses the appearance of expanse, and therefore the *character* of the scene: but he cannot in any way lower the horizon-line, which is and must be above the furthest edge of visible water. He may narrow his field of vision by bringing the sides of his supposed frame to cut off such part as his taste requires; and it is here contended that he should, as a general principle, do that equally on both sides. We say "as a general principle," because in many landscapes the objectionable effect of displacing the *zero* is hardly perceptible: the forms of objects being undetermined, the difference of their geometric and perspective forms is not striking, as it is where any building or rectilinear figures appear in the near part of the picture.

Suppose now the painter dislikes to see the distant spire, &c. in the middle, and wishes to cut off one side out of the circle (as for instance the left, which

will leave them near the left side); he may face a little to the right, and extend his circle that way, which will admit more on the right than is now seen; and at the same time will place the *zero* (still in the centre of his picture) further to the right hand. This he may find will introduce uninteresting scenery on the right, and disfigure his picture. Then he may spread his tree, or any picturesque form on the foreground, which will screen and hide that which he wishes to hide: or he may narrow his field, (but still with the same actual width of frame,) and this will put the remaining objects on a larger scale, but in the same proportions and perspective.

If he dislikes altogether a high horizon, how is he to avoid it? To get rid of it he must descend more or less, and place himself somewhere beyond and below the high foreground towards distance the second. The first effect of this will be, that the blue distance (8) will disappear: next, what little is now seen of the city and distance 7, will follow it; and no river will be visible near the town and fortress. Let him descend a little more, he will have the scene of the flat land No. 3. narrowed, and No. 3. and 4. on the left and the high rock somewhat magnified, and the river widened between them. He will find the effect easier to bring out; and, if he is a good painter, may make a beautiful picture; but it is not the view from the Schlosberg which he has journeyed to see, and of which even a scanty record may be more desirable to him than a better picture of a more common scene.

Of Levels below the Eye; and of Descending Planes.

There is no great difficulty in representing *horizontal levels below the eye* in the *distant* part of the picture. When the flat surface is in the foreground, and therefore near the plane of the picture, it becomes difficult; because in the perspective, equidistant *parallels of latitude* (Def. 19.) are divided by a far greater space on the lower part of the picture than those nearer the horizon-line. (See any of the representations of flat ground-planes in the former part of the work.) If then the foreground of the picture represents flat land, with objects in good perspective and strongly marked, a sudden change of proportion in magnitude and intensity, between objects near to one another in the picture, denotes *distance* in those that are diminished; but *distance* on the level ground-plane gives *height* in the perspective: it becomes therefore evident at once to the spectator that the diminished objects are on a lower level; and that the nearer part of that lower level is hid by the foreground. If it were represented, it would be the broad *sub*-horizon of the former chapter, in which the point of distance is too near the base of the

picture. It produces an anamorphosis which he only who is a master of effect and keeping can force to explain itself*.

Come we now to speak of the *hidden* space mentioned in the last paragraph, —the part between the flat foreground and the visible middle distance of deep but horizontal level: and let us suppose, that instead of an abrupt descent or perpendicular cliff, we have a visible slope downward before the eye. This must be *near* the eye; for a *distant* descending plane must be intercepted by the upper edge of higher foreground.

To take the plainest instance:—If a person stands on a flat floor above a staircase, and at some distance from it, he may see a floor or landing-place below at the foot of the stairs, but not the steps. If he will see the steps themselves, he must approach, within a certain distance, toward the edge of the upper one. The top edge of each succeeding step will then approach that of its preceding nearer step, and the lower ones will come apparently in contact, (see fig. 3. *b*. and 4. *b*. Plate XXI.) and the lowest will be hidden. And of course, if instead of steps the descent consists of an unbroken slope, the same foreshortening of space takes place without those distinguishing divisions which, if visible, the edges of the steps furnish to the eye; and the same is, if the slope be an open diffused surface, as a road, or a descending lawn, &c. &c.

Perhaps there is scarcely any amateur who has made many sketches from nature (we may add artist in the early part of his career), who has not tried to represent down-hill views, and wondered why his drawing will not bear out his conception, and produce the effect. There are probably not a few philosophizing amateurs of pictures (whether professors or not) who have declared it to be an evident impossibility; "for," (they say) "the distant line must be higher on the plane of the picture than a nearer line; and when we see it actually placed above, how can it represent that which is below."

Now it is here asserted, not only that it is feasible, but that it is *evidently* feasible; for, it being admitted that the mind is able to comprehend the sinking of the visible ground-plane in nature, when viewed through a transparent

* The reader is referred to a note in the former part of this work, page 74, where a stone engraving is mentioned, eminent for this species of effect; from which any single object, taken out of its place and traced elsewhere, would appear ludicrously distorted. A carriage with horses (for example) would appear to be standing on the horses' noses, with the hind wheels in the air; yet owing to the good proportions and good keeping of the whole, the paved street down to the base of the picture immediately under the eye of the spectator, is all flat and in its place: (provided always that the picture itself be duly placed, and on that subject there still remains something to be said).

vertical plane, in which vertical plane the visual rays from the distant *lower* line of the landscape intersect *higher* points than those of the nearer and higher lines,—it follows, that *if* the forms, the hues, and the intensity of objects in the picture are the *same* as those of nature intercepted on the transparent plane, the thing is done. It would be absurd then, because contrary to the admitted definition of perspective, to call it an *impossibility:* and it remains to examine only the ground of the *difficulty*.

Now this difficulty cannot consist in the delineation of the forms; for the outline may be determined by rule as decidedly as any other outline. Why is it that the imagination will not follow it readily?

Let us first consider how we represent *any* level in a picture; for the whole space occupied by it in the picture is really vertical.

We mark out a square or a quadrangle, and that is to be the picture. A line drawn or imagined across it at the height of our eye, divides the part above the eye from the part below it. The *whole* may represent an upright wall, part above, and part below our own height. A part may represent a wall at a little distance, and the other part (below it) may be pavement or floor,—flat: but its representation is an upright space in the picture. Above the line it may still be land, a sloping plane, ascending, (as a mountain,) or it may be a horizontal stratum of cloud, the under side of a *superior* horizontal plane. (Def. 4.)

What distinguishes then the flat from the upright or sloping, or from the descending superior? It must be answered, "the apparent distance" of the extreme (highest) part of this *lower* upright space, or the lowest part of the superior space. Well then, if the apparent distance of the extreme division gives to the upright space an appearance of *horizontal level,* will not an *equal* appearance of distance of the extreme division of a *narrower* space, or a *greater* appearance of distance of an *equal* space, give the appearance of *descent?* All other circumstances being equal, it certainly will. What then are the circumstances, the variations in which render the cases so different?

The appearance of rising, descending, or flatness of any plane in the perspective, depends on its relation to the horizon-line, and on the proportion the height of that line bears to the length of the line of distance. This has been explained in preceding chapters. There is a certain space, vertical in the plane of the picture, which, if the eye is high, will appear to rise, and not represent much distance in the picture: if the eye is lower, the apparent distance will increase.

If an object of known magnitude (as a man) be placed near the base of the

picture, and another of the same size above it, at the end of a second line of the space, a spectator at once conceives that equal objects are equally distant from the plane of the picture, and therefore the vertical space *in the picture* represents an *original* vertical space. If the upper figure is represented as somewhat smaller than the lower, it is plain that it is more distant, and therefore the plane must be intended to appear as sloping upwards; if its diminution be in a greater degree, it may appear to be horizontal; and if the upper figure be still more diminished (always supposed that the keeping be in conformity to the intended distance), it may be reasonably expected to represent *descent*. The lines are those which the pane of glass would exhibit; but, unfortunately for the painter, the eye of the spectator always tells him that there is *surface* before him, on which the lines and colours are spread. The difference between transparent surface, which does not *arrest* the visual rays, and opaque surface from which those rays originally proceed, is discussed before, with both its causes and effect (see page 6 to 9); and this appearance of surface greatly destroys the illusion desired. Still this takes place in the perspective of *level* plane, as well as in that of descending plane, though in a less degree.

Now it has been shown that the descending slope in the original cannot be seen but from a height above the horizontal ground-plane near the eye (a somewhat enlarged *sub*-horizon); and it has been shown that the *violence* of the perspective increases near the base of the picture, the only part on which the descending slope can be visible. (In all cases the *violence* increases with the *angular distance** of any point in the picture, from that to which the eye is directed perpendicularly, whether it be lateral or vertical; and this violence, together with the perception of *surface*, destroys (or prevents the image-creating power of the mind from conjuring up,) the desired illusory image. Still the same art which, in the case first stated, has acted on the imagination, and caused it to bring down the extreme of the vertical space really near, to appear as a distant termination of a horizontal level, if carried further, may in degree produce the greater effect; and leading the imagination a step further,

* *Angular distance* is the apparent distance between any two visible objects as measured by a line to which the line of sight is perpendicular. It is shown in Plate XIX. fig. 1.

The perspective of a line proceeding directly to the eye is a mere point, without measurement of length. Visual rays (right lines,) from any two objects wide of each other, form an angle at the eye; and a line from one of them to the other completes a triangle, as *a. b. e.* Plate XIX. fig. 1.: *e* is the eye, *a* the first object, and *b* the second. If these objects are at an equal distance from the eye, the two visual rays will be of equal length, forming one triangle with two equal sides: so will it if a line be drawn from the first object *a*, to cut the visual ray of the second object *b*, (as *a. o.*) This last line is the base of an equal-sided triangle, and subtends a certain

bring the *level* to a sloping *descent*. It is in degree only, not in principle, that the cases differ: but the degree is very great, both for the reason just given, and also because the horizontal ground-plane is that which is most commonly before our eyes (as the floors of the apartments we dwell in, and the streets and fields we walk in). The rising plane is not less frequent than the descending plane; but then it is always visible when before us: but (as has just been shown) the descending slope is most usually *hidden*. Thus, all our associations of perceptions with ideas, are against the illusion in the latter case.

It is probable that persons who live in mountainous countries, or who are accustomed to watch from very high posts, understand the design of a picture of this sort more easily than others do. In fact the men who act as guides over the mountains of Switzerland, enter readily into the meaning of the sketches of travellers: and no doubt if any persons spent most of their time in a lofty gallery under a dome, or near the roof of a cathedral or lofty building, the inverted picture mentioned in page 26 would represent to their imagination the flat floor in its true level: and it is certain that persons in general who are accustomed to view pictures, catch readily and habitually all the effects of representation, as to lines, shading, colour, and the *touch* of the draughtsman. A common person sees an old deep etching of a Hercules, or a wood-cut from a picture by Rembrandt, and thinks it is spoilt by those ugly scratches. A fine line-engraving of a recumbent Venus, or a Cupid and Psyche, appears to him as displaying figures covered with network or gauze; while the more cultivated eye *loses* the *lines*, and the imagination is led by them into all the roundness or the flexible contour of the muscles, and even the texture and lubricity of the skin.

In like manner the cultivated or habituated eye (by which word, as applied to pictures, is meant, not the organ of sense, but the imagination excited by

angle at the eye, the said base *a. o.* being the measure of that angle; and this is called the *angular distance* of these two objects, *a.* and *b.*

o. 2. is another object on the same line, *e. b.* but at a less real distance from *a.*; but its angular distance is the same, because its visual ray (or right line running to the eye) is the same. Now either *a.* or *b.* might be at any distance or position whatever; viz. an object on the ground-plane near, or at the horizon; a bird in the air, or a spot in a cloud, or a planet, or a fixed star; still the line *a. o.* is the *angular distance* of any of them from *a.* The *angular distance* of two stars is the imaginary line joining them on the great concave perspective of Newton and La Place and Herschel, &c.: or, more properly speaking, it is the measure of the angle which the visual rays of the two stars form at the eye; and it will be in all cases *the perspective* of an imaginary line joining the real points, whatever may be their relative distances.

its perception,) takes the effect of perspective: and the mind, measuring and estimating by habit and unconsciously, the proportions of objects of known magnitude, and their intensity of light, shade, and touch, associates those perceptions with ideas of distance beyond the visible vertical plane, or *surface* of the picture, and forms its estimates of *level* from those associations. The image to which it is most accustomed is called up most readily, and the less frequent, with more difficulty.

The painter, desirous to produce the effect, will address himself to the *reasoning powers* first; he will *prove* the level by the introduction of some object that cannot be mistaken. The lesser magnitude in perspective, of two objects known to be equal in nature,—the convergency of two lines known to be parallel in the original, and the *degrees* of these proportions, and the gradual fainting off of the outline and shading, will do much. The representation of the surface of water will be decisive as to level. Then a greater diminution in an equal space on the surface, introduced into the same picture, will be demonstrative of the intention; and perhaps the introduction of level, particularly of sea, *beyond*, will help the imagination. The evident representation also of the *upper* surfaces of objects, (the crown of a man's hat, or the back of a horse, or the interior of an empty waggon, &c. &c.) proves that the objects must be below the eye; but these proofs addressed to the reason will not always awake the imagination; and the painter must endeavour to *lead* that insensibly; carrying further the same helps he uses to give his vertical space the appearance of horizontal level. Even thus he will be sometimes disappointed: for having placed an *evidently* level plane in one part of his picture, when he foreshortens the adjacent ground and diminishes his figures, he may find that the first effect is, only to throw up the first part, and make that appear to rise, which before was seen to be horizontal; and he will generally find that while some persons exclaim, How well that down-hill slope appears, others will be unable to see it. On the other hand, he will have the satisfaction frequently of finding, that those whose imagination did not take it at first, catch it afterwards and admire the effect.

In Plate XXI. an attempt has been made to express a descending staircase; and to make it plainer to the reader, by following up the same figure in a variety of positions.

Fig. 1. is the profile or side view of a succession of four steps which may be supposed to be altogether one solid structure, the highest part being nearly of the height of a man. The end of the structure is shown on the right hand of the plate, with the four equal divisions or strata; and it shows the intended width

of the structure, and of course the two together give the form of the ground-plan.

Fig. 2. represents two profiles of the same, with the width to complete the solid, brought into perspective. One fig. on each side of the centre; but in other respects the two are similar. (They are put in on a smaller scale than fig. 1. because they would otherwise extend beyond the plate).

Fig. 3. represents three such solid structures on the same scale as fig. 1.: and all three on equal ground-plans parallel to each other, and perpendicular to the plane of the picture: but the lower end of the structure is presented to the front in the first of them, *a*, and the higher end in the third, *b*: *c* is the same as *a*, but in the middle of the picture; so its sides are unseen.

a and *c* therefore represent *ascent*, and *b*, *descent;* but in this figure the upper edges of the lowest steps become hidden by the plane of the upper step or landing place, except on the side vertical to the radius of the ground-plan.

Fig. 4. is still on the same scale. It contains two structures, one rising and one descending. The ground-plans are equal and similar between themselves, and also with those of fig. 3.: but the horizon-line is raised, which extends the *perspective* of the ground-plan, and also all the level surfaces; and thus shows the edges and part of the surfaces of each stair in the descending structure*.

In Plate XVI. there is an attempt to exhibit the effect of descent without actual steps, but with divided slopes, like those ascents which are sometimes made (as in the Vatican and other buildings, the ground of which may be trod by horses or men); and the Author had prepared some drawings intended to express down-hill slopes in landscape: but he finds he must desist from increasing the number of his plates; and recommends his readers, as an interesting amusement, to make their own experiments on the principle. The thing is not impossible; for though specimens of the effect are rare, they do exist. It is of more use than seems to be generally supposed: for by the practice of it the artist's sphere of action becomes far less confined.

Somewhat akin to this part of the subject is that of *placing* the picture to be viewed as mentioned in page 18, and also the possibility of producing a picture, the imaginary horizon-line of which may be *out* of the picture, above or below, as mentioned in the same page.

* The point of sight in this figure, as in many others, is nearer than so small a picture will bear; because few eyes can see distinctly at the distance of a *few* inches. If the student will copy this on an enlarged scale, (double the size of the whole picture, which consists of the two structures, with the *zero* in its place,) and also attend to a gradual fainting off of the strength of outline, he will probably find that he has made an apparent *descent* to lines higher in the picture.

As this book is addressed to amateurs, little personal anecdotes may be allowed by way of familiar explanation; which in a work with more pretension to science would be ill placed.

At one of the early exhibitions of painting in water-colours, the author, returning into one of the rooms he had before visited, found a party sitting, who called his attention with some ridicule to a largish painting near them: and the *gist* of their criticism was, that the surface of a lake appeared sloping like the side of a hill. He said, "I have just bought that picture; admiring it for the expression of effect directly opposite to that which you are ridiculing; viz. that the lake is shown to be at a great depth below the eye, yet the level of its surface seems so decidedly expressed." There was nothing more to be said, but that "we see with different eyes."

At the close of the exhibition the picture was sent home; and upon receiving a visit from the same party, the purchaser set his portfolio on a chair before them, with the picture propped up against the back. There was not one that did not immediately admire it for that particular excellence. The change in their mode of conception of its expression is easily accounted for. In the first instance they were sitting, and the picture was *above* their eyes, and they were *near as well as below.* In the second, the picture was a little below them, and they chose their distance.

In the case of the engraving by Duryer, mentioned before, the author purchased it, seeing it accidentally in a shop-window; and pinned it up against the side of a room. Some perceived the effect at first, and some doubted; but when he lowered it on the wall, it was evident to all.

Now the observation which the author adds to these anecdotes, applicable in this place, is, that when once this effect is caught in the imagination, it is not lost by removing the picture to the place in which it was doubted. The eye that is accustomed to it, will find it out; as the eye of a person accustomed to see pictures at all, makes out the intention of a landscape, which appears to be seen *through* the opening in the frame, though seen obliquely from points far from the true point of sight, and from a situation in which, if the picture were a window, the real landscape could not possibly be seen through it.

In a picture the author has, by Francis Nicholson, a mountain torrent has carried away a bridge, of which the two buttresses remain gaping, with irregularly broken ends; the crown of the arches being destroyed. The beauty of the picture consists much in the cloudy summit of the mountain itself: but the eye is led up to it by the gradation of broken rock, and tumbling and

foaming water. At the exhibition, the direction of the two ends of the bridge did not appear as if they could coincide if the arch were to be reconstructed; but afterwards, when the picture was placed on a wall *above* the eye, and viewed from a *near* station, it was evident that the springing of the arch from the opposite buttresses in the direction of their remaining ends would bring them exactly together. The painter was representing a scene entirely above his point of station; he was correct in his perspective, and he leads the spectator to the sublime scene itself, to which of course he should *raise* his eye. The horizon-line is *out of the picture,* and *below* it; and the effect excellent. If Duryer's picture were cut off at the top, it would be *injured* as to its effect, but the perspective of the street would not be *destroyed,* and the horizon-line would be *out of the picture,* and *above* it.

It may be not out of its place here to notice the principle some artists adopt, of placing their horizon-line high or low in portraits or in chamber scenes. We shall here refer to Mr. Hayter's doctrine, mentioned in page 11 of this Supplement. He seems to think (and the supposition is not uncommon,) that a dignity is given to the subject by placing the imaginary line low; *i. e.* by making the figure appear as if on a pedestal, or perhaps adding to his apparent stature.

As a question of *perspective,* we admit that the low horizon-line will have the effect of raising the subject; but as a question of taste, we take leave to differ. The question of taste, though not quite belonging to our present subject, is not wholly unconnected with it; because a mention of the consequence of habit and association has been more than once introduced; and the prevalence of peculiar representation has been said to improve, or to render morbid, the eye and the imagination. It is much to be wished that the general taste of those who have a pleasure in contemplating pictures should not be misled (as the Author thinks it is) by the liberties painters take, and their contrivances to produce particular effects not consonant to truth, nor consistent in the several parts. The stature of a man *is* the stature of a man. Give your hero a place in the *group* (if such is the composition of the picture) that shall direct the spectator's eye and mind to him, and let others be subordinate; but make nothing preternatural. Give him pre-eminence by avoiding minute detail in other objects, and in the still-life and accompaniments; not by putting him in on a different scale. If we see a public building introduced as apposite to the history, it is disgusting to see it in the proportion of a child's toy. If we see the chair on which a great

man sits, copied minutely to show the grain of the wood, and the hole from which a brass nail has escaped, it is bad taste; but it is worse than bad taste to cock up the frame of the chair into a position from which the person must inevitably slip forwards, and to let the grave man appear balancing himself upon his toes, and propping himself up by putting his forefinger on a scroll of paper.

If the picture be but the *portrait of a cow*, still it is desirable that there shall be an appearance of *weight* pressing on the ground. (Sawrey Gilpin's cows stand heavily, and his stags as lightly, on the grass.) If it be a *Psyche* borne by Zephyrs, (and a beautiful modern marble there is, by Gibson, that illustrates the position most happily,) the light pressure on the ground,—light, like that of a butterfly on a rose-leaf, is magically delectable. No false perspective will give this; but minute observance of *truth* in nature will afterwards fill the mind of the artist with associated recollections of the minute incidents on which effect depends. The spectator does not know, nor perhaps care to know, the foundation of the pleasing illusion; but he enjoys it, and the enjoyment improves his taste and his perception of beauty generally.

As to the "dog and the elephant" of Mr. Hayter, (Vide *ante* page 11.) the thing is too evident to require much comment. A dog *is* below us: an elephant is (or at least his back is,) above us, if standing on the same level; but the relation of the horizon-line is, to the level of the ground-plane, not to the height of the object placed upon it.

Let the dog run up a bank, and he is above the horizon-line. Now we should think that that position is the one from which "a portrait of a dog" should be taken, which is exactly contrary to Mr. Hayter's recommendation. If an artist would paint a dog on the ground-plane, *near*, the dog's back only would be seen; and he would be (like the horses *taken out* of Duryer's picture) standing on his nose; for this is the *anamorphosis* of a *near sub*-horizon. If the line of distance be long, the animal is too far off for a *portrait*. The dog must be placed as if on a table, or chair, or bank of some kind, on a level (or nearly so) with the real horizon. The elephant, on the contrary, we shall see better, if we mount on a stage or ladder; and that gives a *high* horizon.

To go back to the question whether it is right or "allowable to dispense with the strict laws of perspective," we must here contend that it is the *practice* that has created the apparent *necessity*. We expect it, because we are in the habit of seeing it in drawings of buildings, &c. The instance in which the writers seem most ready to produce a justification of the departure

from the truth, is, that of the representation of columns in a row, parallel to the plane of the picture.

Mr. Kirby quotes from Mr. Fresnoy, "though perspective cannot be called a perfect rule for designing, yet it is a great succour to art, and facilitates the dispatch of the work, though *frequently falling into error,*" (geometry falling into error!) "it makes us behold things *under a false aspect,*" (the representation of lines on a vertical plane, *as they are seen,* a false aspect!) "for bodies are not always represented according to the geometrical plan, *but such as they appear to the sight.*" Then the author (Kirby) goes on himself: "Suppose it were required to draw the representation of a row of columns parallel to the picture; if they are drawn according to the strict rules of perspective, then that column which is in the centre of the picture will be the least, and consequently those on each side of it will be larger and larger continually, the further they are removed from the centre of the picture;" and then, after demonstrating this, he adds, "The definition I have given of the word perspective is this; to draw the representations of objects *as they appear to the eye;*" (this is the definition *everybody* gives,) "for since the fallacies of vision are so many and so great," (query whether such do exist,) "and since we form our common judgment and estimation *of* the appearance of objects *from* custom and experience," (rather say, we form our estimation of their *forms,* &c. *from* their appearance and our habits of observing;) "therefore," he continues, "it seems reasonable not to comply with the strict rules of mathematical perspective in some particular cases, but to draw the representations of objects *as they appear to the eye.*" Now what are the *rules* of perspective *but* the *method of drawing* them as they appear to the eye? They are not arbitrary laws by which a painter is supposed to be bound. They are *registers* of *appearances,* and the modes of *imitating* appearances. Appearance is the whole of a painter's study: but there is an ambiguity in the word "appearance."

It has been before observed, that when a man sees himself in a mirror, the image in the glass seems (*appears,*) to him as large as himself,—*i. e.* it suggests such a stature to his *imagination,*—but not to his *eye.* If he sees another man standing at six yards before him, a second at twelve, and a third at twenty-four, and so on, they all *appear* to him of their natural size. Do they appear so to his eye? Certainly not. Each one forms an image in his eye of half the height of the preceding one; but they appear to his mind equal. The eye estimates (rather let us say, measures) the height at the true distance; the mind by "custom and experience,"—habit, association,—esti-

mates what would be the height if the object were near. One is the "appearance" in the bodily organ, the other the "appearance" in the mind an judgment.

There is no "fallacy of the vision." (Mr. Nicholson, as well as Mr. Kirby, supposes it, and says, "of the organs of sense, the eye is one of the most acute*, but it is the most deceptive of them all.") The eye never deceives. It conveys faithfully the intelligence of the direction in which the visual rays enter it; and it pretends to nothing more. If the ray is bent by refraction or returned by reflection, and our habits and experience lead us to imagine that it comes straight, that is not the fault of the eye. The eye reports the *last* direction.

Mr. Varley also notices this question, and contends, that "since pictures are not generally seen from one point of sight only, if drawn for the *perspective of one* such point only, their perspective will not be true, as seen from any other point;" and he seems to inculcate that therefore they must be made a *little* wrong *in all* positions, rather than be *correct in one* and *more wrong* in others: and the reasoning is fair and plausible. This is putting it on the footing of what is called temperament in music. In a keyed instrument, we know that one key represents two notes; as for instance, F sharp and G flat; G sharp and A flat; and so on: but F sharp is not the same tone as G flat: and if such instrument is made perfectly in tune for one key, it will be out of tune in all others; and in some flagrantly so. There is therefore a little "give and take," according to the system and the discretion of the tuner; and he makes all the keys a little (some more, some less) out of tune, that the offensive discord of the worst may be softened.

In perspective, as in music, it becomes a question of *expediency* and *discretion*.

Mr. Varley afterwards says, that "if in drawing two columns of equal size, and equally distant from the ground-line of the picture, you were to make the one in the centre of the picture smaller in width than the one which, being near the edge of the picture, is more distant from the spectator, this, though true, according to the rules of the art, would appear to *reverse* the general practice of the science." (*He* also seems to forget that the appearance of

* As to *acuteness*, we have no standard whereby to compare the organs of sense one with another. Mr. Nicholson would be puzzled to estimate the *acuteness* of the ear which distinguishes between the pulsations of the air excited by the child's words *papa* and *mama*, or the syllables *yes* and *no*; or even that feels the coincidences of unison tones, or accordant harmonious intervals.

diminution of objects according to the distance, relates to their distance, not from *the eye,* but from the *plane of the picture,* the edges of which plane recede from the eye in *the same proportion* as the *side objects* in the original;) and he goes on to say, "that N. Poussin and others make their buildings differ little from direct elevation, their top lines being generally horizontal; and the perspective made obvious, principally in their different magnitudes according to their distance." (Mr. Varley's practice is very different from his preaching, if the Author may judge from some fine specimens he has, which he at least would value much less if the oblique lines of his buildings were made horizontal, or if his "views inclined to the panoramic," which he also vindicates.) On the subject of *authority* we have spoken before, page 21; and indeed Mr. Varley himself nearly sets it aside, when he speaks of "the faults of great painters in a measure concealed by other excellencies," (*i. e.* if a picture had faults only and no excellencies, it would not be worth looking at; true enough:) but if the faults were removed, the excellencies would not be impaired. In truth, *indolence* is the real foundation of the practice.

For the statement of the case of "the columns," the reader is referred to Plate XI. Prob. XVII. and to the question put by Kirby, "whether the columns situated at the side of the picture are to be thus represented or not," we must answer "YES."

In the diagrams in the present and in other books, the *anamorphosis* is much stronger than will generally (if ever) happen in pictures, for the reasons given before: and for such as will appear in pictures, the eye that perceives the truth will become reconciled to it.

But the case, though very *analogous* to that here put, viz. the temperament of musical instruments, is not the *same;* the one being irremediable, the other not. We *must* play in different keys; and if we cannot supply the mechanism, we must be contented with an imperfect substitute: but in drawing, if a certain appearance in nature (or the original subject) be unpleasing, why choose it for representation? Tell it *truly, or* let it alone. You are relating an anecdote, or you are composing a story for entertainment. But the writer says, "if I tell it truly, as it *did* happen, or as it *might* happen, there is neither entertainment nor interest in it;"—then omit it. If you would represent some interesting phænomenon in nature, as the eruption of a volcano, for example, paint faithfully what you see, though the cloud should assume the form of a "whale, a camel, or an ousel;" but don't *choose* a stiff or fantastic cloud for a picture of a common storm. So may we say of the drawing of a colon-

nade. If you are making a real representation of architecture, draw it faithfully: but if the picture is intended for pleasing the eye and the imagination, why *choose* a station directly opposite a column, and place it in the centre of the picture? Face a little in another direction, in the manner shown in Plate XVI. figs. 1. & 2. and let the colonnade stand obliquely to the view, or represent the whole façade as further off, and all will come in elegantly and with truth. Besides, if you change the proportion of some columns and not of others, what is to become of the intercolumniation? of the proportions of the façade beyond? of the fluting of the columns themselves? of the pavement on which they stand? in short, of all divisions of space in the portion of the building—the nave, side-aisles, windows, arches, roof? You may as well attempt to give a map with the miles in one part longer than those in another.

Figure 3. Plate XIX. may prove somewhat illustrative of the case. It represents a pavement divided into equal perspective squares: circles inscribed in these squares; vertical lines showing what would be the outlines of columns erected on those circles; and it will be seen, that if one of those should occupy more or less space than belongs to it, the whole would be in confusion: the base of the picture is divided into seven equal parts, from which the squares are constructed; they are numbered in succession from the left, No. 4 being the central division. If in each one of any number of *original* contiguous squares a circle be included (of the full size), the several parallel diameters will touch each other; and vertical lines erected on the points of contact would be the outlines of the several columns, which also would of course be in contact. In the *perspective* also, (for performing which, see Prob. X. Plate IV., or fig. 8. and 9. Plate XIV.) the diameters would be in contact; but it has been shown (Plate XI. Prob. XVII.) that the perspective of a diameter of a circle is not the longest line that can be drawn in the perspective circle: and since the visible outlines of any individual column stand on the ends of the longest visible line, the outer visible line of any one column (meaning by "outer," furthest from the centre of the picture) will project beyond, and therefore hide, the inner outline of the next outer column. This is shown in No. 6. and 7., where, if the column of No. 6. were completed and shaded to appear solid, a considerable portion of No. 7. would be hidden *.

By the appearance of *great vertical heights,* mentioned in the title to this chapter, is meant, the deceptive appearance in magnitude of such objects as are at a great height above or below the spectator. When we look directly

* No notice is taken here of the tapering, nor of the bulge of columns. The cylindric form, though never used in architecture, is more simple as an explanation of principle, though its representation would be very unpicturesque.

or nearly so, upwards or downwards, the apparent diminution of the object is much greater than in horizontal distances. Thus, if we look along an avenue of trees, of any length (suppose five hundred feet), the apparent closing in of the further part, measures the distance from the eye, and the objects diminish in the same proportion; and there is no deception in the appearance of either width, length, or magnitude. But if we look up to a tower or spire of that height, or of half that height, we are less able to estimate the distances; and it is notorious that the objects appear of far less than their real magnitude. Take for instance, (any one will suffice,) the square tower of the cathedral at Malines (Mechlin); near the summit of which there is, on the exterior, a gilt metal circle, being the dial of the clock. The spectator looking up to it, may estimate it at twelve feet diameter. In the *Grande Place,* there is a stone paved circle on the ground, of thirty-six feet diameter, with twelve divisions corresponding to the hours of the clock-face: and the whole is said to be on the same scale of magnitude as the clock. To the spectator it appears incredible. The imagination refuses to take it in; yet the reason is easily convinced of the truth; for if the spectator observes the width between the buttresses on the ground plane, and then carries his eye upwards, following the parallel vertical lines, he will see that the circle above, is between the same parallels, and in contact with them, and therefore must be of the same width.

Now why is it, that if a road of thirty-six feet wide, and of a length equal to the height of this tower, had circles described in it, one near our feet and the other at the further end, equally filling the width of that road, our eye would readily perceive their equality; while in the vertical distance the imagination cannot follow it? One reason, no doubt, is, that there are no intermediate objects on the side, graduating off proportionally with the distance; which in the case of the road will usually accompany the scene, and lead the mind to the conception of the truth; and thus the high parallels appear to approach more rapidly, and the appearance of height is diminished: but the principal reason is, that in viewing it, we must cast our aspect violently upwards; and the line of sight is no longer perpendicular to the plane of perspective, to which the tower itself is, of course, parallel. (The reader is now referred to the preceding problems demonstrating that the line of sight must be perpendicular to that plane.)

The extraordinary height will be quite out of the field of vision. In the case of the panorama, the *cylindric* concave surface admits an *unlimited field of vision* in *width,* and a *spherical* concave surface would admit it in *height;* but a plane surface cannot admit either.

How then can any really lofty structure be truly represented in a picture? The answer is, by giving the picture a very long line of distance.

The tower of Strasbourg cathedral is said to be 490 feet high. It is impossible to see this then, in undisturbed proportion, from a distance less than five hundred feet; and then from a station of half that height: or, from twice that distance (one thousand feet), if the station be on the ground. But if no such station can be found, it is impossible to draw it by the eye.

The painter then must, by the rules of perspective, draw it *as* from that distance. The line of distance of a picture must be at least equal to double the *vertical height above the horizon-line*, that being half the *vertical field of vision*. (See page 1. of this Supplement.)

Architects, finding how much of magnitude objects lose when placed on high, are apt to make them on a gigantic scale; and this may be deemed judicious or otherwise, according to the nature and design of the whole work.

Is the object (a statue for instance) the principal, and the structure belonging to the statue? or is the structure the principal (as a church or temple), and the statues or other objects ornaments or accompaniments to it? In the first case, the effect may correspond with the intention: in the second, to make the statue gigantic, is to sacrifice the principal design to that which should be subordinate. It is to present an exhibition-room for decorations, instead of a decorated edifice.

The books of travels are apt to parrot from one to another, that notwithstanding the immensity of the structure of St. Peter's at Rome, the proportions of the interior are *so just*, that it appears to be no larger than those edifices which in measurement will not compare with it; when the fact is, that in consequence of the *dis*proportions of the ornaments, it loses in great measure the stupendous effect which ought to be produced in a structure which the life of a man some thousand times multiplied has been spent in raising.

If we see an eagle soaring aloft, and appearing as a speck in the air, it leads the imagination up to his region of majestic solitude: and if an architect could send up a similar artificial object to that height, and instead of the natural span of seven feet of an eagle's wings, were to increase it to five times seven (which is not a greater magnifying power than Michael Angelo has used), the *deceptive* proportion of his eagle would make it appear to be in that region which the skylark occupies; and this is precisely what the architect has done in that dome, which might have appeared like the vault of heaven with angels in the air, graduating off into infinity.

He has done the same thing with the statues below; but there his deception is contradicted by the appearance of natural man; for the immense area of

floor is never deserted by living beings; and their known magnitude restores the appearance of expanse. Ten thousand persons kneel uncrowded on that floor; but a few scattered individuals are sufficient to show the truth.

Neither let it be deemed arrogant in an amateur to criticize the work of Michael Angelo. Those who commend, profess their own judgement as much as those who express their feelings on the other side. But are we sure that it was the genuine taste of the great artist? Did he not consider whom he had to please in the disposal of his ornaments? Display of splendour, profusion of ornament, richness, rareness, the proof of human labour, and of astonishing expense of time and money bestowed on their places of worship, and that principally in *decoration*, is what gratifies the multitude in preference to the sublimest genuine effect.

On Refraction; and particularly that of the Atmosphere; and on Imperfect and mixed Reflections from the Surfaces of transparent Bodies.

Hitherto the appearance of objects in perspective, as consisting of points and lines formed by visual rays proceeding in right lines only, has been considered; but with a mention of a modification, afterwards to be noticed.

Now the rays of light never do proceed in perfectly straight lines, except through a *vacuum*, or through a perfectly uniform medium. They are bent at every change (whether increase or diminution) of density; and the atmosphere consists of strata of varying density. The lowest part of the atmosphere is most dense, always from the pressure of the superincumbent air; sometimes because the cold condenses portions above, which descend and drive up that which is warmer, and therefore lighter: and sometimes the density below, is increased by contact with a colder surface, as by water or earth, covered with snow, &c. &c. Its density varies too by saturation with moisture, or the contrary: and the imperfect mixture of strata so varied, disturbs the otherwise rectilinear rays of light.

Whatever be the temporary cause, the effect is, a slight curvature of the visual rays from distant objects; and as the causes vary, so is the effect greater at some times than others. The curvature is sometimes very perceptible, sometimes barely so, and sometimes imperceptible*.

* To a spectator looking across the wide part of the Thames, the rise of the tide (probably from its raising a cold stratum of air to a level with a less dense stratum) frequently renders visible cattle and other objects on the opposite side, at too great a distance on low flat ground to be seen otherwise. It elevates them as water does objects in a vessel below the eye. In peculiar states of the atmosphere, land is often visible over a wide channel of sea, at distances from which straight visual rays would be intercepted by the curvature of the surface of the sea.

Its visible but varying effect is highly picturesque; and it is generally sufficient to remove, in some degree, the perfectly straight (as it were, *ruled*) appearance that would follow from mathematical perspective. Claude sometimes overdoes it in his buildings, as far as *truth* is concerned: but his picture gains airiness, and perhaps sublimity by it. A great poet may step a little beyond nature in his description, and so may a great painter: but either of them should *know* when he does so; he should know what truth is, or probability, or possibility at least, and use discretion even in hyperbole. Lesser artists must be more cautious.

Again, all transparent media reflect and refract, as well as transmit. Indeed if they did not, we could not see them. We could not see the difference between an empty glass, and a glass full or half full of water. We could not see the difference between water, air, and glass.

This reflection and refraction have each a powerful effect in perspective.

When a ray of light strikes perpendicularly on the surface of clear transparent water, the greater part of it penetrates the water. When it strikes obliquely, a part penetrates and a part is reflected from the surface; and at very small angles, nearly the whole is reflected. Now this reflection from surface is greatly increased in rays proceeding from *within the water*. The visual rays from objects under the water suffer a very far greater degree of reflection at the surface, (or rather a far greater proportion of the quantity of rays suffers reflection) in proportion to their obliquity; and of course cannot reach the eye, unless the eye be directed to the surface of the water, at a very great angle: and thus we fall into the old difficulty of representing objects near our feet; and this difficulty is greatly increased by the phænomenon in question.

From this cause arises the almost impossibility of introducing a representation of transparent water with a bottom of pebbles, &c.,—a pleasing appearance in a foreground in nature, and a characteristic accompaniment of rural summer scenery: because in order to view it in nature, we must look directly downwards, or nearly so; and thus it cannot be brought into our vertical field of vision. It requires too deep a *sub*-horizon.

Thus the reflection from the surface of water puts it out of our power to represent one pleasing incident; but it leaves us to enjoy the amusing appearance in nature; and it affords to the painter another very fine one, the *reflection* of objects from the still surface of a lake, or the ripple of a stream. On this subject, and on shadows, the Author would fain have said something; but his book grows too long and too expensive. He thinks an attentive reader

will be able to make out by analogy the theory of the perspective of reflections from the surface of water, and of shadows; and many books contain good instructions on the subject, while some, not deficient in other particulars, make blunders in this. Amongst the good ones, Francis Nicholson's will be found useful.

In considering these phænomena, it will be at once apparent, how mixed must be their effects, in drawing as well as in painting; *i. e.* as affecting the forms and proportions as well as the tints. Proportions, in perspective, we have seen, are compounded of magnitude and distance, inversely; and also of aspect and position. The stature of a man upright, is to that of another upright and equal figure, as the squares of their distances. If the figure lies down, (still parallel to the base of the picture,) its length is still equal to the upright length of one equally distant; but if it be perpendicular or oblique to the plane of the picture, it is shortened in the proportions we have shown in the problems. But the extreme points of any such line in the picture may denote the boundary of a short vertical line, or of a long or *very* long receding line. Two upright lines, with a slight convergence, may be the outlines of a ladder, or they may be the two sides of a road or a river; and the distinction must be given by what is called

Keeping;

that is, giving the idea of relative *distance* by the diminution of *intensity* of light, shade, colour, and contrast: by imitation of the effect of intervening atmosphere, as well as the actual loss of distinctness of line from diminution in quantity of visual rays; it is by this that the painter supplies the grand desideratum of making the spectator lose the idea of surface, and seem to penetrate space, and make his *superficies* to represent *bulk*. This is the first object of linear perspective, the proper subject of this treatise; but it leads to what is called

Aerial Perspective,

of which, though generally beyond the matters here proposed, a certain degree may find place. It is effected principally in colouring, but is yet capable of being represented in black and white.

One further particular should be added, (and this is fully within our bounds,) viz. that there is also a

Perspective of Touch.

The same pencilling that is fit for a foreground, would in the distance entirely destroy the perspective: the works of amateurs too frequently fail to

distinguish a distant mountain from a hill hard by; and this distinction lies in the keeping, aerial perspective, and touch: much of it belongs to the *art* of drawing and painting, which this treatise does not presume to include.

The theory may be right, but the practice may fail. A knowledge of grammar will not make a poet, nor even constitute an elegant style of prose: but neither can any one be a poet, or enjoy poetry or elegance of style, in a language of which he does not know the grammar.

If the reader has found that the perusal of this treatise has given him an insight into the THEORY OF PERSPECTIVE,—the grammar of the science of drawing,—the Author leaves him here to his own genius and the instruction of the artist for his PRACTICE.

THE END.

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Fig 3

Fig 2

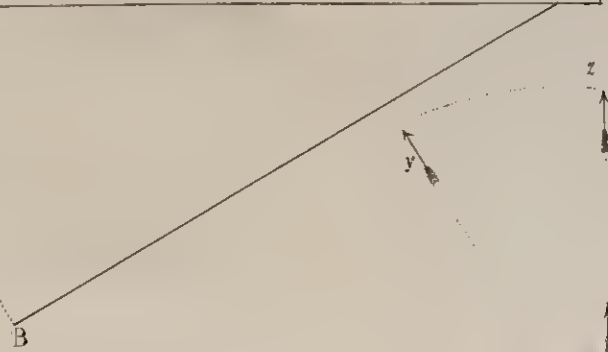

Fig 1 b

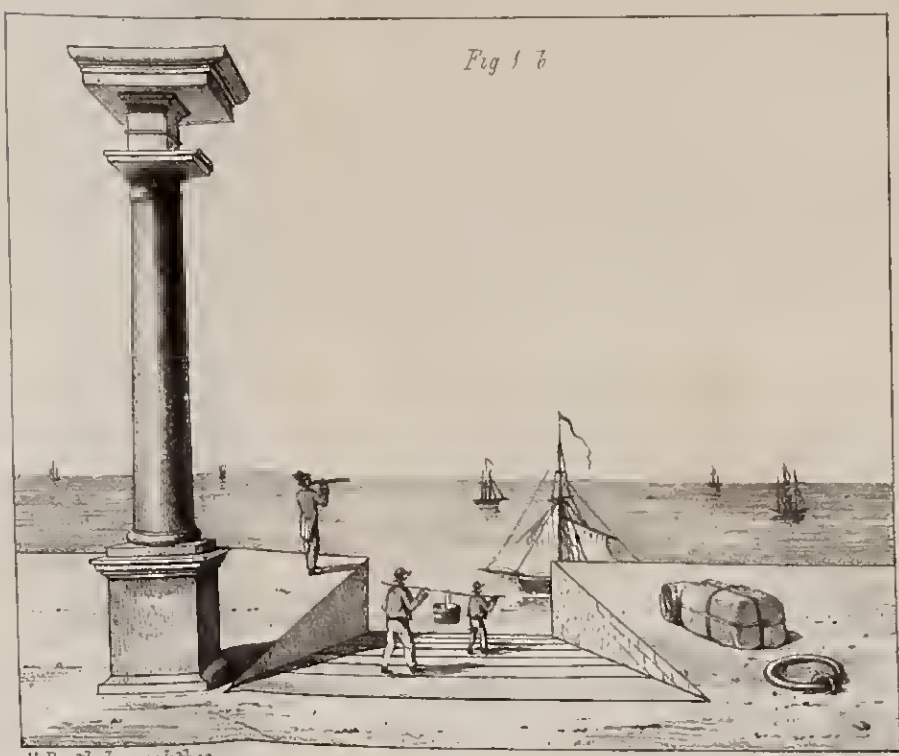

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Fig 1 a

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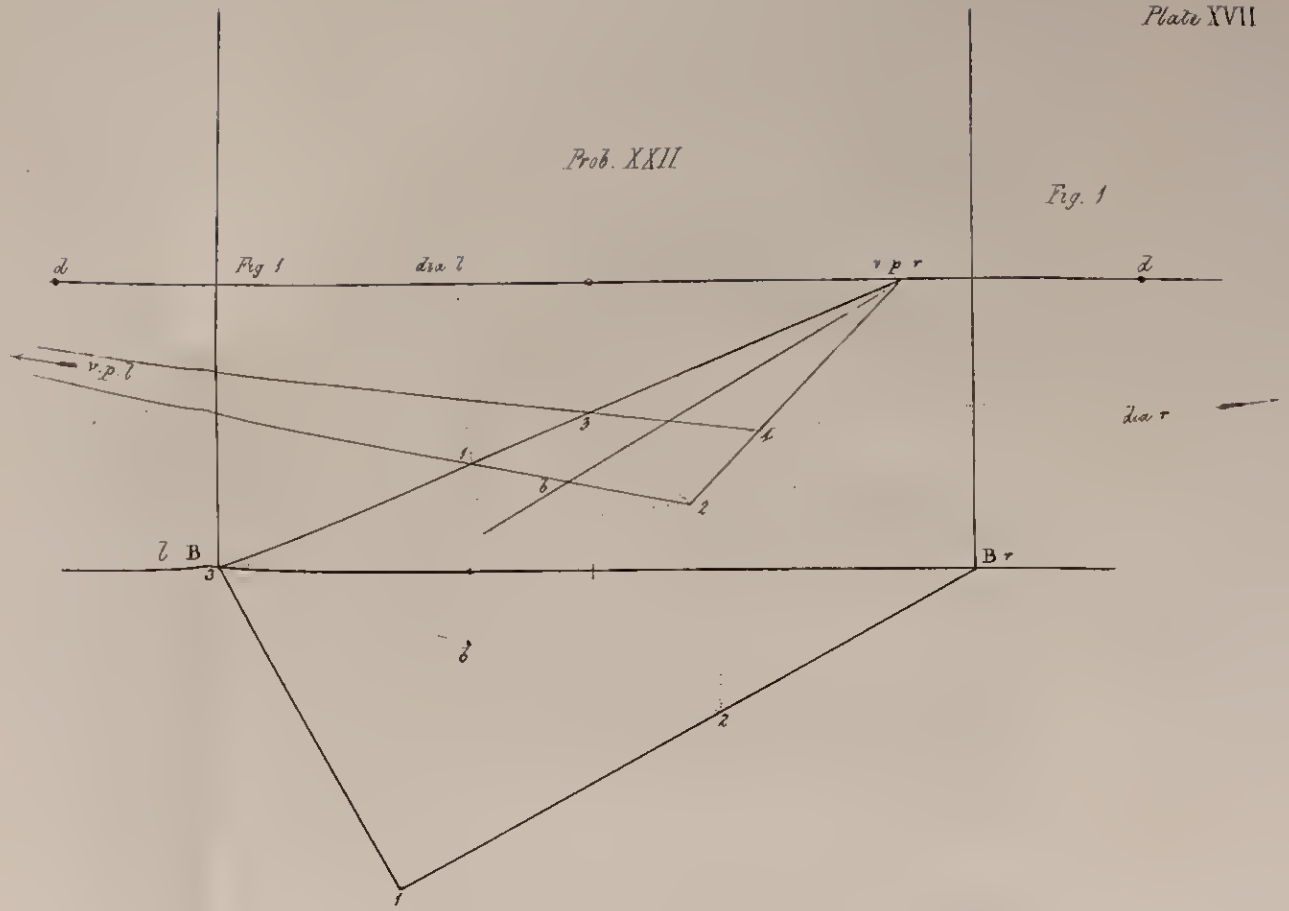

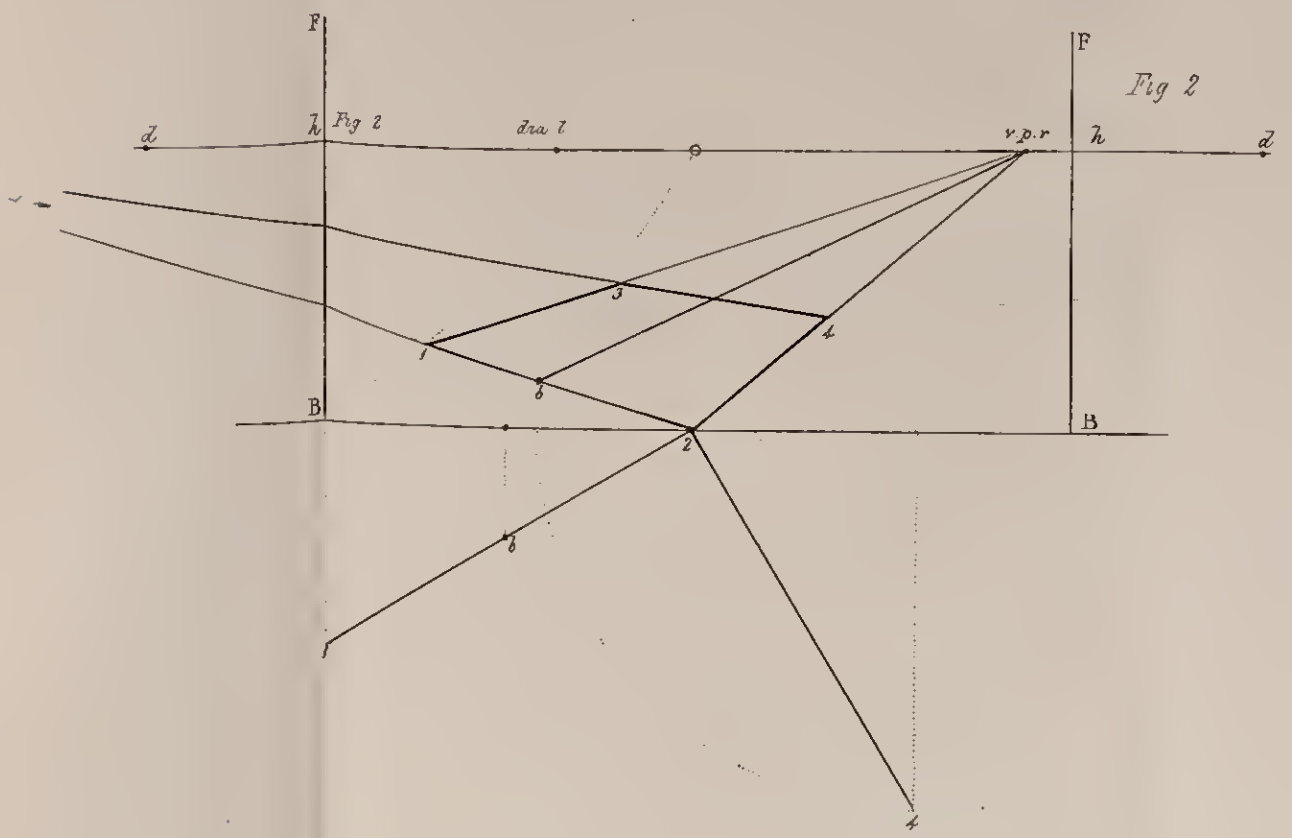

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Prob XXIV

Fig 1

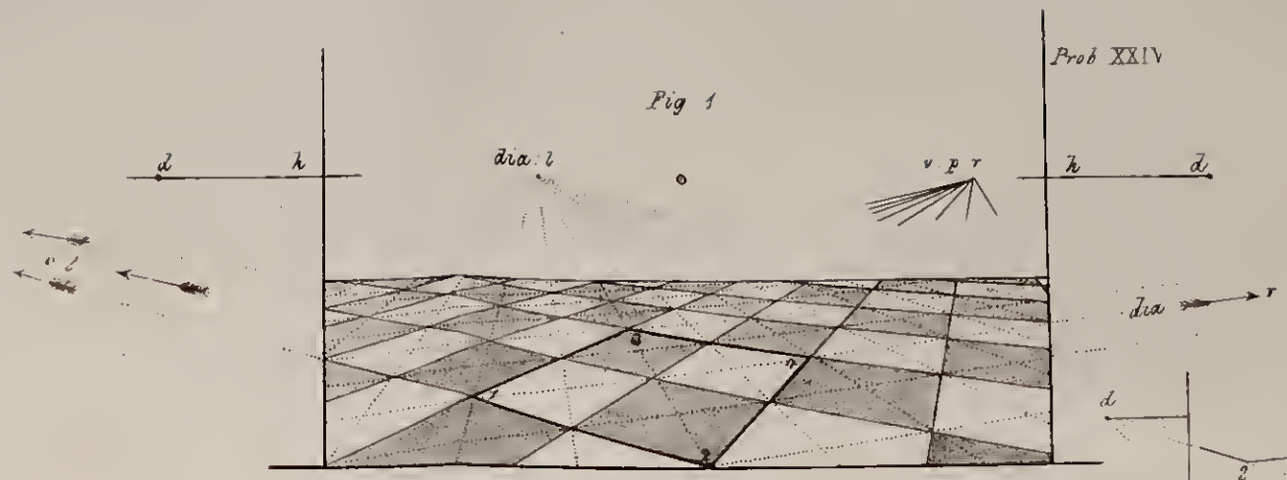
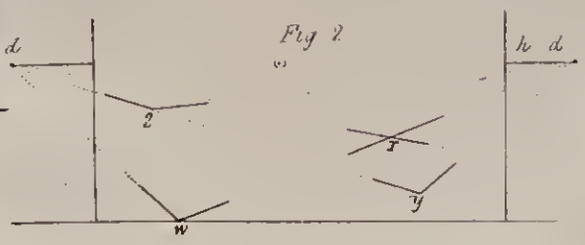


Fig 2



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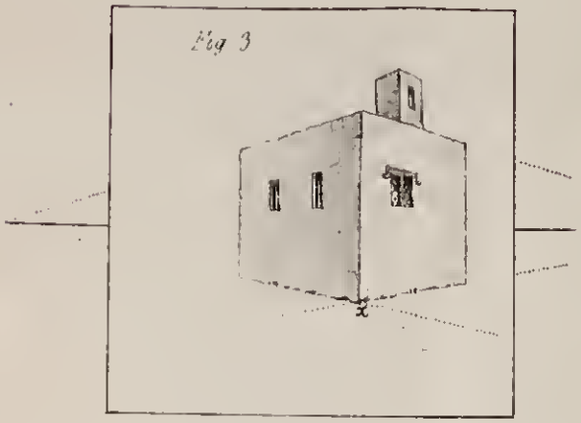

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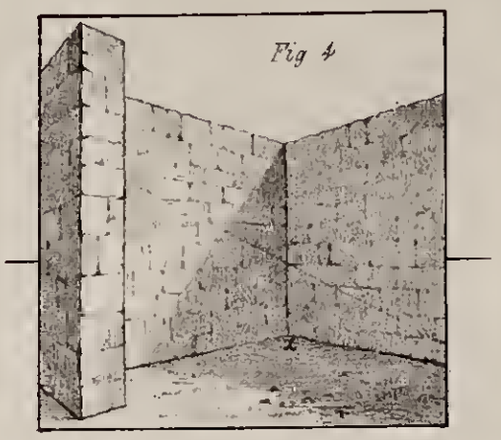
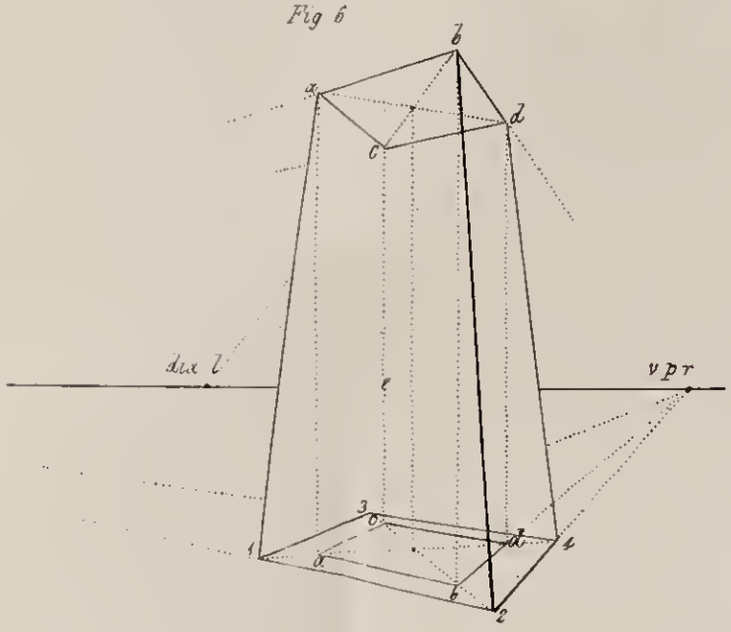


Fig 5.

Prob XXV

Fig 6



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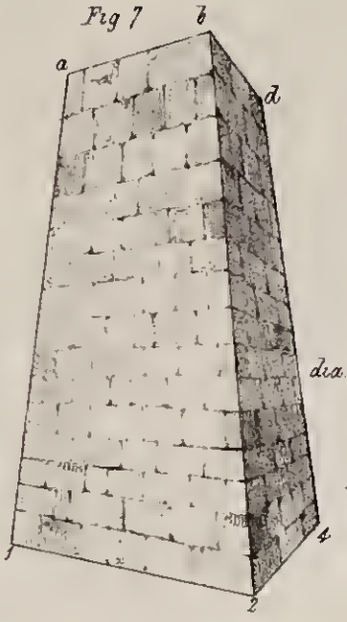

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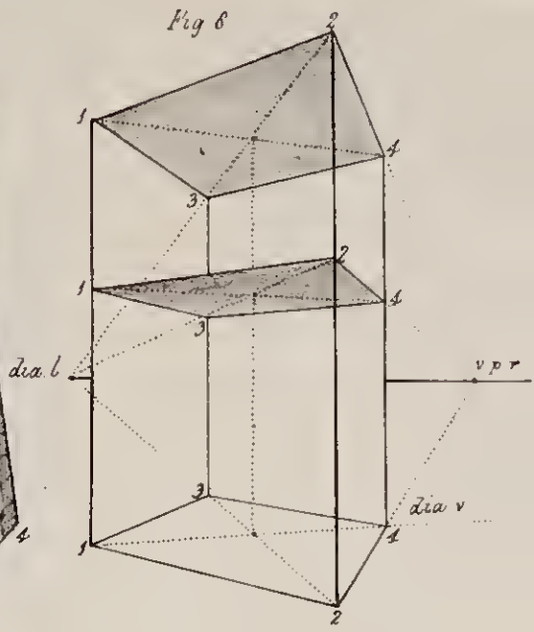

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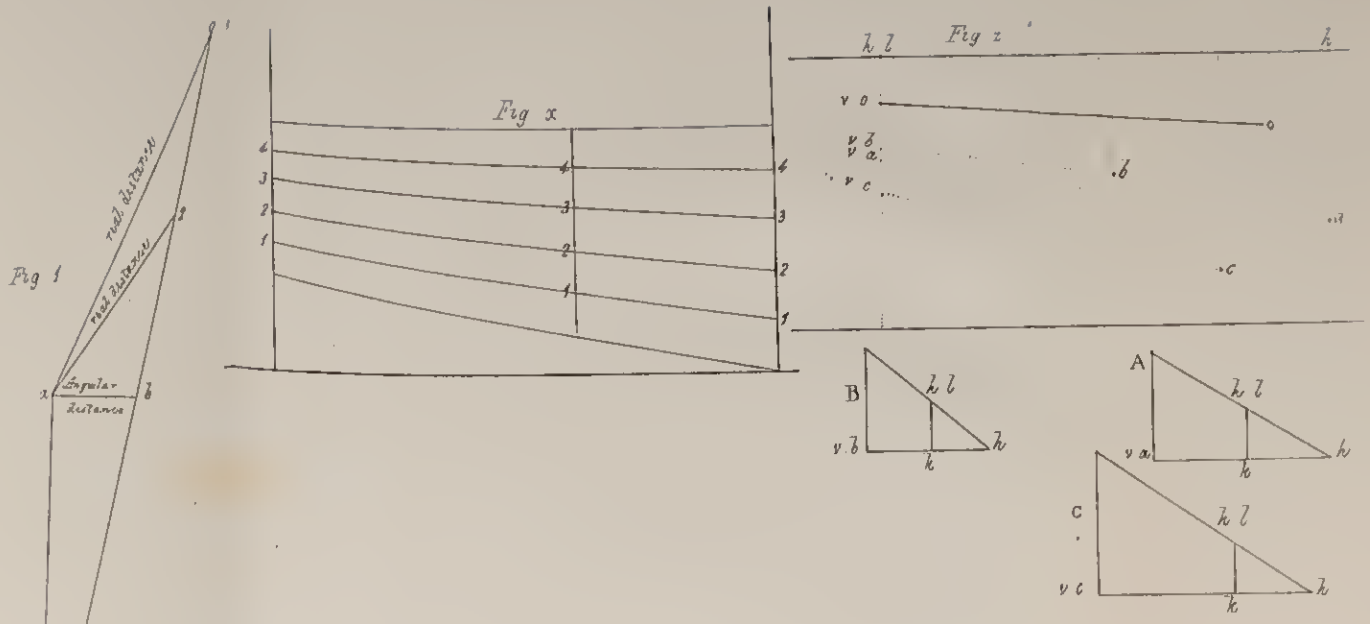

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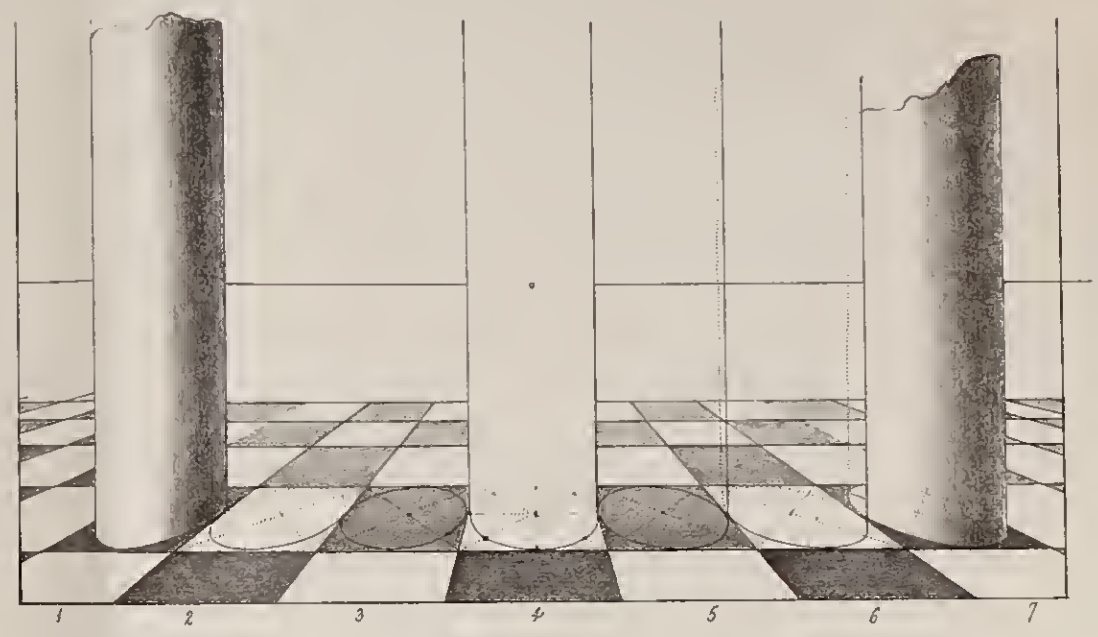

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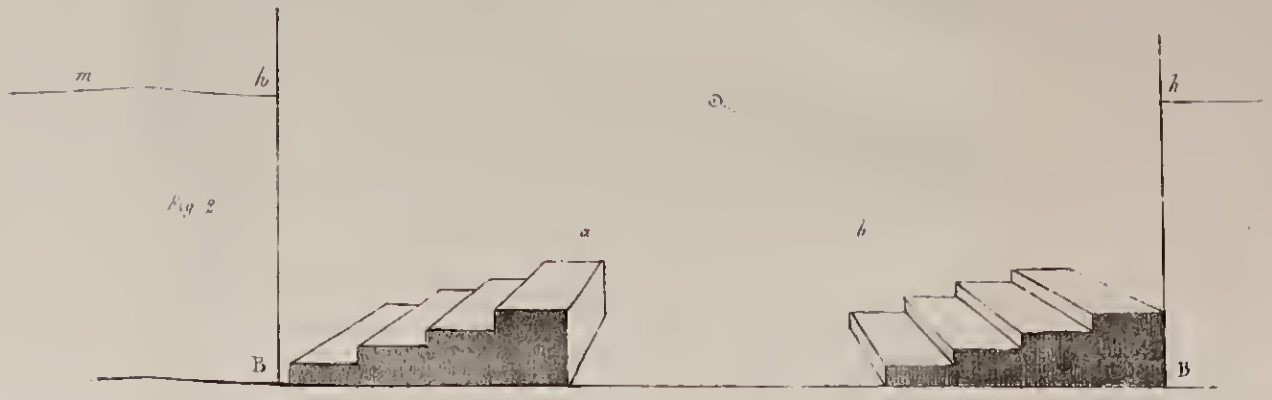
Plate XX.

Plate XXI

Fig 1

Fig 2



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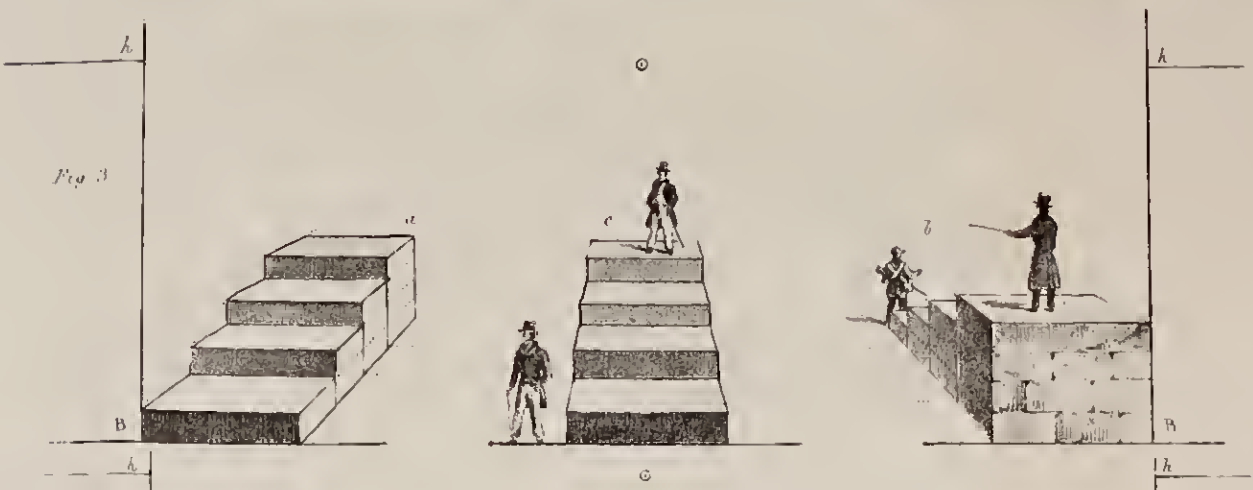
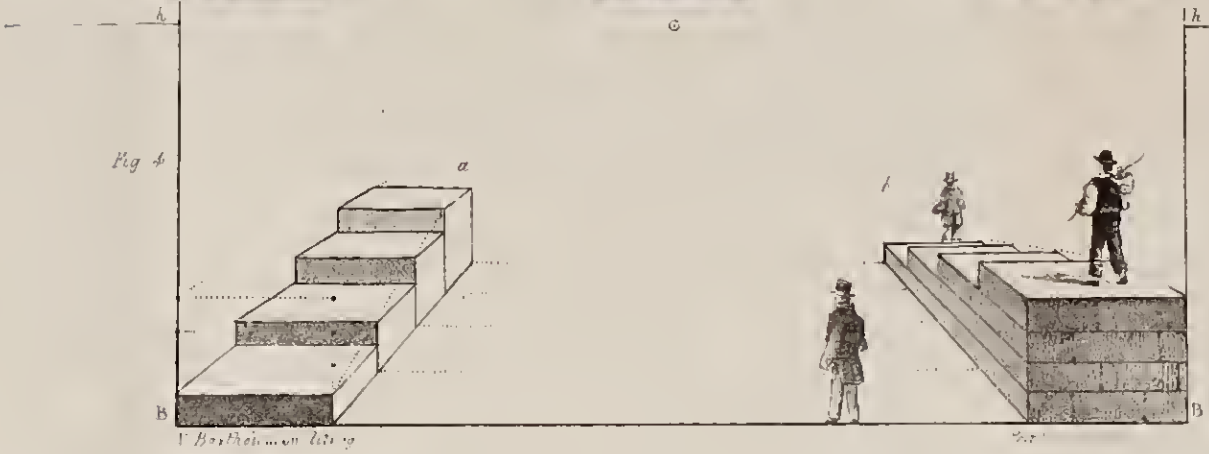
Fig 4